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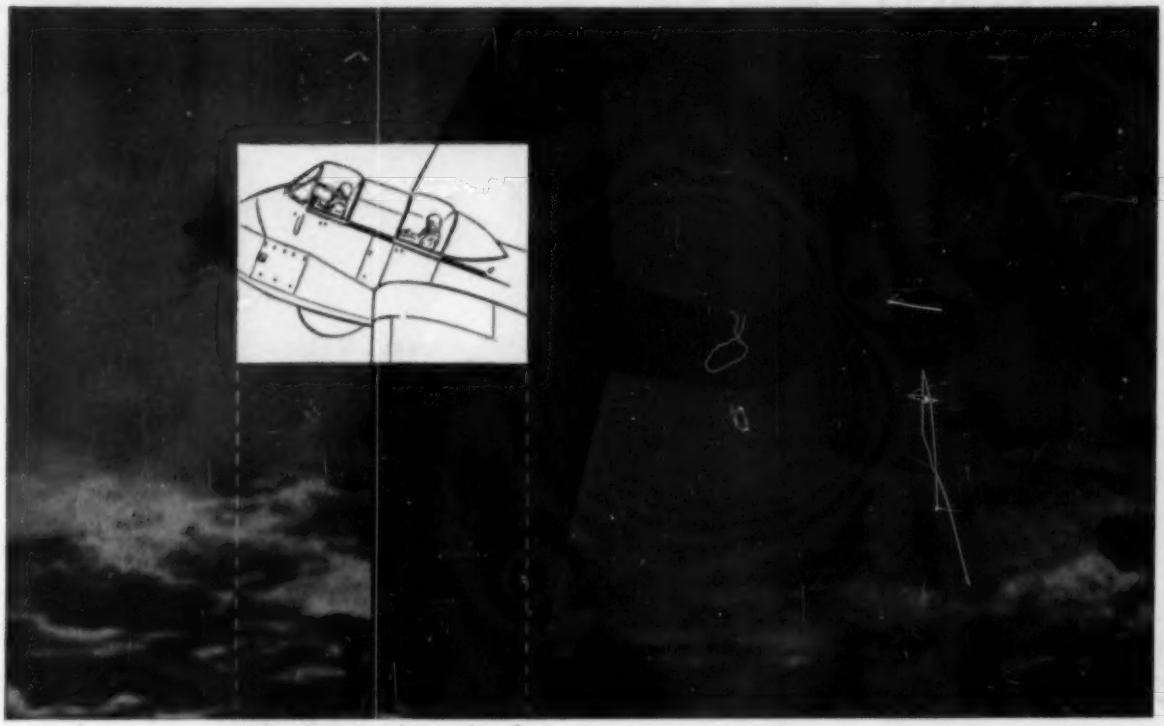

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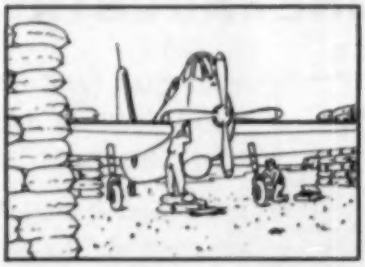

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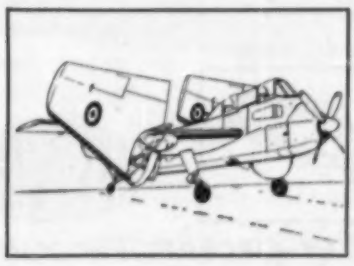

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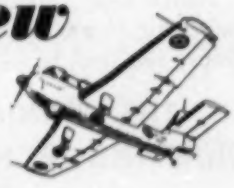

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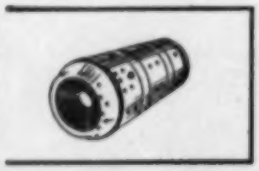

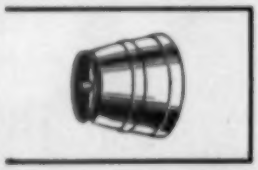

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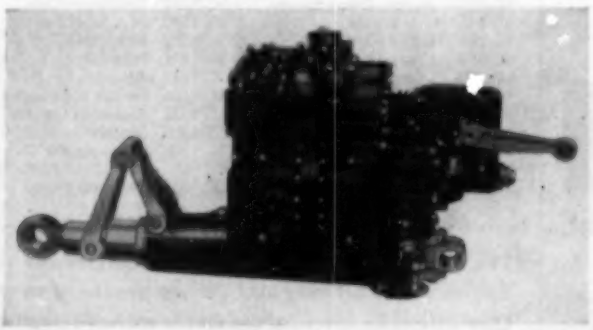

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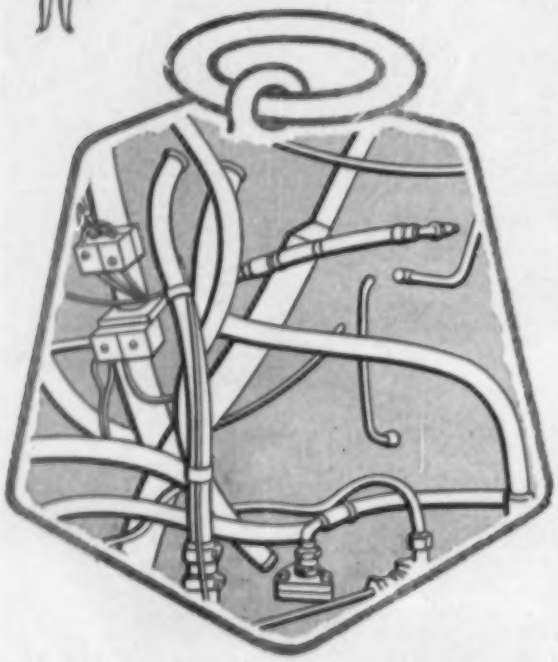

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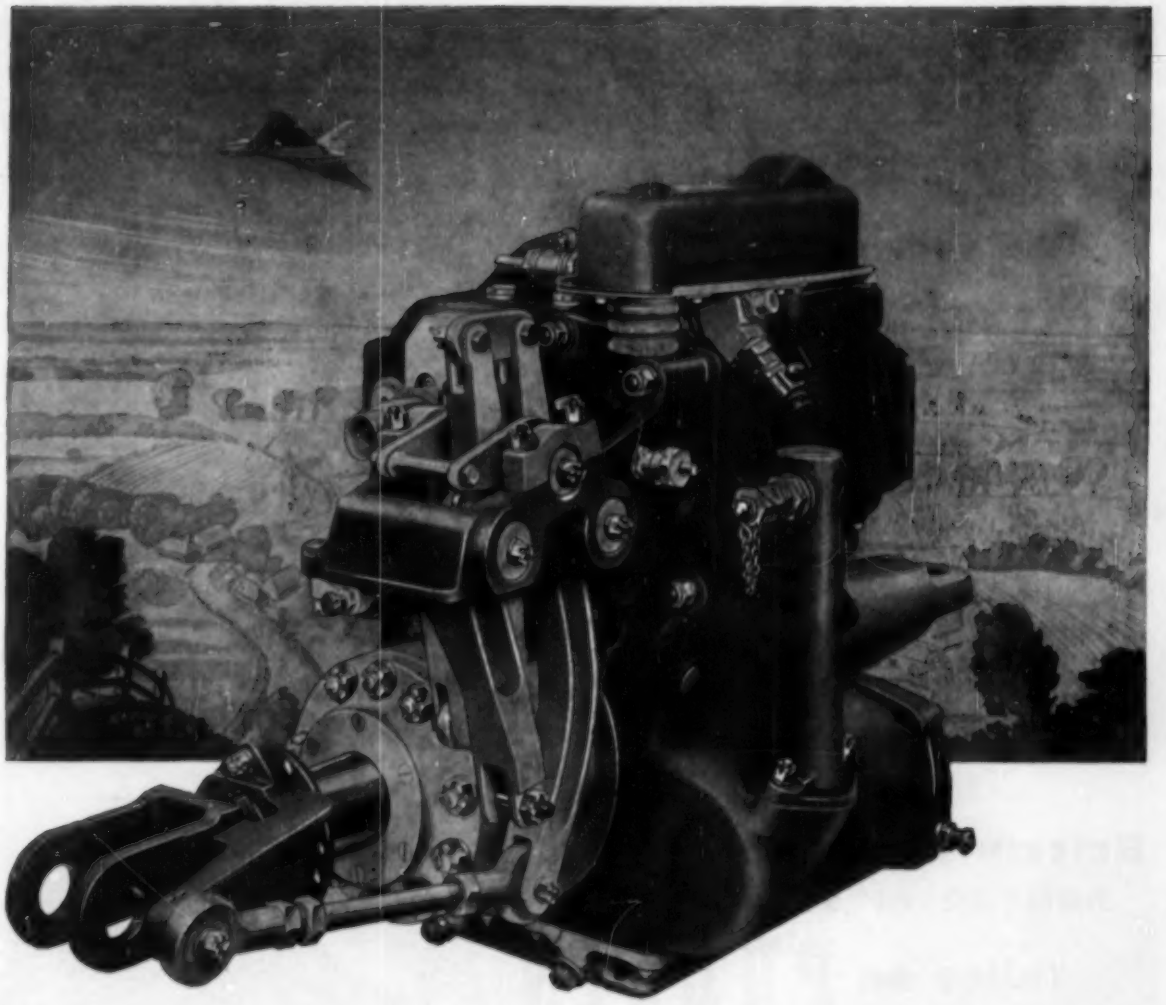

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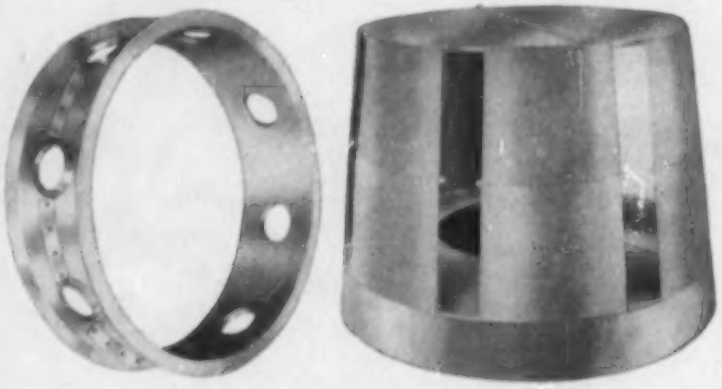

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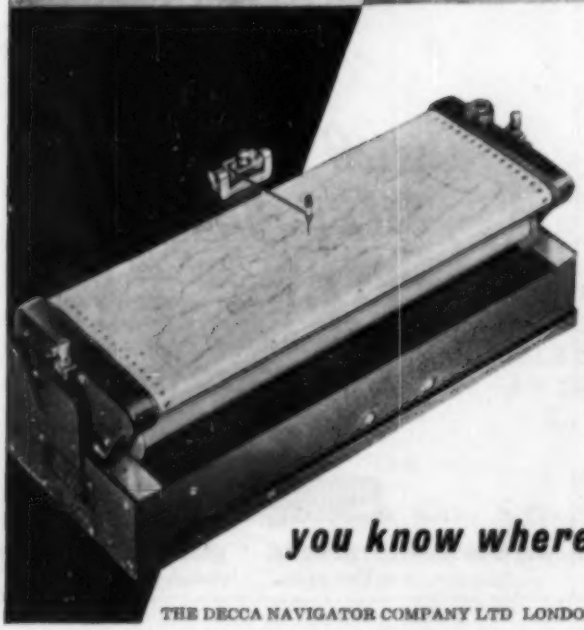

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The order for 12 Viscount 810D aircraft by Continental Air Lines, Inc., of Denver, U.S.A., brings the total number of Viscounts sold and on order to 254. Continental Air Lines is the second American scheduled operator to order Viscounts.

Due for delivery in 1958, the Viscount 810D will be powered by four Rolls-Royce R.Da.7/1 engines giving a cruising speed of 363 m.p.h. In 1959 these will be replaced by R.Da.8 engines increasing the cruising speed to 400 m.p.h. and the aircraft type will then be known as the Viscount 840.

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FLIGHT
and
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C

Field and Farm

THE traditionally extolled lot of the farmer's boy—to plough and sow, to reap and mow—is a poor range of accomplishment in terms of modern needs. Indeed, the whole pastoral scene has changed in recent times to something akin to a military operation, with an armoury of new vehicles and devices—not least the aeroplane—being brought to bear in support of the rudimentary implements of yore.

In some thirty years the numbers of agricultural aircraft have swelled to a five-figure total, with over 7,000 serving in the U.S.A. alone, while their range of usefulness has broadened into new spheres of achievement and promise. Principal among these is crop-treatment—the dusting or spraying of crops with powders or liquids to control or extirpate insect or vegetable pests; and next is pest control, whereby the pestilential breeding areas are sprayed from the air with liquids or powders. Seeding and top-dressing, survey and surveillance, fire-fighting, afforestation, the dropping of fencing, fodder or poison bait, and the protection of valuable crops against frost are already commonplace undertakings, while national peculiarities of terrain or fauna are promoting less widespread if more romantic applications. Thus, in New Zealand the wild-deer shooters, who range through the mountainous districts curbing the great herds, are maintained with necessities and simple comforts; and, in Canada, marauding coyotes are picked off by marksmen flying a few feet above the prairie snow and firing from open cockpits or doorless cabins.

The Implements

While adaptations of standard light and medium machines preponderate for the present in agricultural pursuits, the call for specialization (sounded loud and clear by H.R.H. the Duke of Edinburgh in his Commonwealth and Empire Lecture last year) is beginning to receive a due response. Aircraft designed and developed not only for the farm, but in the closest collaboration with the farmer himself, are now reality in this country as well as overseas; indeed, the newest and most promising of all are the Auster Agricola and Edgar Percival P.9, both of which were briefly introduced in these pages on December 16th. The latter is more fully described in this issue. So promising, in fact, is the potential market for these machines, especially for top-dressing work in New Zealand, that until the actual emergence of the prototypes the responsible companies maintained a silence so rigid that less was known of design characteristics than of forthcoming interceptors and bombers. Now the wraps are off. The new contenders are preparing for the rough-and-tumble life, and the makers have released their jealously protected secrets to agriculturists at large.

To assess the merits of the new machines would at this stage be premature; but the specifications are eloquent in themselves. Evidence is abundant that each was designed with imagination and with full understanding of the operational problems involved, and each is backed with lengthy experience of overseas markets. Equally gratifying, both are one hundred per cent private ventures, planned in a businesslike manner, with an eye strictly to business, and without benefit of grant or subsidy—planned, in fact, in the belief that the world, and the British Commonwealth especially, has need of such equipment, and that great things lies ahead for the right aeroplanes in the right jobs.

But though the Agricola and P.9 are the first Commonwealth aircraft to have been planned from the outset for farm-work, they are not the first to have been specifically tailored for Commonwealth service. It was of the de Havilland Canada Beaver that the Duke observed that, when it was first mooted, the makers took trouble to find out exactly what the bush pilots of Canada really wanted, and throughout its development their opinions, their experience and criticisms were sought and used. The secret of success, he remarked, seemed to be the very closest co-operation between the makers and operators. Counsel, it would appear, that did not pass unheeded.

FROM ALL QUARTERS

The New Ministers

THE Air Ministry and the Ministry of Transport and Civil Aviation are among those affected by the Ministerial changes announced by the Prime Minister last week. The new Air Minister is Mr. Nigel Birch, in succession to Lord De L'Isle and Dudley, V.C., on whom has been conferred a viscountcy; and Mr. Harold Watkinson becomes Minister of Transport and Civil Aviation in succession to Mr. Boyd-Carpenter, who takes over the Ministry of Pensions and National Insurance. Among the junior Ministers, Mr. Christopher Soames becomes Parliamentary Under-Secretary of State, Air Ministry, and Mr. George Ward, formerly Parliamentary Under-Secretary, Air Ministry, moves over to the corresponding post in the Admiralty.

Mr. Nigel Birch, O.B.E., has been Conservative member for West Flint since 1950 and Parliamentary Secretary to the Ministry of Defence since 1952. Now forty-nine years of age, he was educated at Eton and during the war served in the K.R.R.C. and on the General Staff; in 1944 he had attained the rank of lieutenant colonel. He will not come to the Air Ministry as a stranger, for he was Parliamentary Under-Secretary for Air in 1951-52.

Mr. Harold Watkinson also has previous experience of his new Ministry; he was Parliamentary Secretary for Transport and Civil Aviation in 1951-52, since when he has been Parliamentary Secretary to the Ministry of Labour and National Service. He has been Conservative member for Woking since 1950.

Born in 1910, Mr. Watkinson was educated at Queen's College, Taunton and King's College, London, and, after being engaged in his family's business from 1929-35, was occupied with technical and engineering journalism from 1935 to 1939. During the war he served in the R.N.V.R. and at one time was lieutenant commander in charge of training at the Anti-Aircraft range at Eastney. In 1948 he was chairman of the Machine Tool Trades Association's production efficiency panel for Southern England.

Mr. Christopher Soames, who is the son-in-law of Sir Winston Churchill, is 35 years of age and was educated at Eton and Sandhurst. He had a distinguished war record in the Coldstream Guards and in 1946-47 was assistant military attaché in Paris. He has represented Bedford in Parliament since 1950.

Mr. Birch.

Mr. Watkinson.

The following correspondence between Lord De L'Isle and Dudley and Sir Anthony Eden was published concurrently with the announcement of the new appointments:—

My Dear Prime Minister, You have known for some time that should you wish to reconstruct the Government I was very ready to resign the office which it has been my privilege to hold for the past four years.

You have told me that owing to the greatly increased importance of the Air you now wish the Secretary of State for Air to sit in the House of Commons.

The time has therefore arrived for me to place my resignation in your hands. . . .

May I add my best wishes for the continued success of the Government you lead and of the causes which it represents.—*Yours sincerely,*

DE L'ISLE AND DUDLEY.

***BACKGROUND IN THE FOREGROUND:** Ranged before the Boeing 707 are the people directly associated with the flight-test and development programme. In front, left to right, are the three pilots, J. R. Gannett, A. M. Johnston and R. L. Loesch. On the left is the ground crew, at centre the inspectors, in the right foreground the flight-test engineers, and behind them the liaison and instrumentation engineers and representatives of other supporting services. The ten girls represent the data reduction group, and the filing cabinets contain much of the information gathered to date. Beyond the 707 are B-52 bombers.*

The Prime Minister's reply was:—

My Dear Bill, Thank you so much for your letter and for your kindness and understanding in making the Office of Secretary of State for Air available at this time for a member of the House of Commons. You have given distinguished service to the country in this office. The whole Air Force at home and abroad have come to know of your devotion to the Service.

We shall all have the happiest memories of our work with you in these last years.—*Yours sincerely,* ANTHONY EDEN.

N.P.L. Acting Director Appointed

THE resignation of Sir Edward C. Bullard, Sc.D., F.R.S., from the Directorship of the National Physical Laboratory takes effect tomorrow, December 31st. The Department of Scientific and Industrial Research states that the appointment of a successor to Sir Edward will be announced in due course. In the meantime, and pending the taking up of office by a new Director, the Lord President of the Council has appointed Dr. R. L. Smith-Rose, C.B.E., D.Sc., M.I.E.E., Director of Radio Research in the D.S.I.R., to be Acting Director, with effect from January 1st.

For Project Vanguard

OPERATIONS manager of Project Vanguard—development of the world's first man-made earth satellite—will be N. Elliott Felt, Jr. Announcing this, the Glenn L. Martin Company state that Mr. Felt will direct planning, design and manufacture of the three-stage rocket which will carry the satellite into space. He served for 2½ years as an infantryman during the late war and is well known in the field of rocketry. His was the responsibility for designing the guidance system of the Martin Viking, which set the world's altitude record of 158 miles for single-stage vehicles.

Vanguard is to be launched some time during the International Geophysical Year—actually the 18-month period from July 1st, 1957, to December 31st, 1958. The satellite will be carried by the Martin-built rocket and will then be, as the manufacturers say, "blasted into its orbit," where it will circle the earth at some 18,000 miles an hour. Meanwhile it will record and transmit scientific data.

Saro Pilots

IT may be inferred from the announcement that G. A. V. Tyson is handing over his duties as chief test pilot at Saunders-Roe to Mr. J. S. Booth that "Johnny" Booth will be the pilot of the S.R.53 mixed-power fighter, now under construction at Cowes.

Geoffrey Tyson joined Saunders-Roe in 1946, when he followed his old chief Sir Arthur Gouge from Short Brothers at Rochester. Born in 1907, he served in the R.A.F. from 1926 until 1931 and was subsequently an instructor, demonstration pilot, Avro test pilot, a development pilot on the staff of Flight Refuelling, Ltd., and chief test pilot at Shorts. He is recognized as one of the world's greatest exponents of the aerobatic art.

Mr. Booth, who will take over his duties from February 1st, joined Mr. Tyson's test-flying staff at Shorts. In 1949, having served in the meantime with Short Brothers and Harland at Belfast, he rejoined Mr. Tyson at Cowes.

Sir Keith Smith

WE record with deep regret the death in Sydney on December 19th of Sir Keith Smith, K.B.E., F.R.G.S., F.R.Ae.S., M.Inst.T., a pioneer long-distance airman and latterly Australian and a director of Qantas Empire representative of Vickers, Ltd., Airways.

Sir Keith Smith.

Keith Macpherson Smith was born in Adelaide on December 20th, 1890. He joined the R.F.C. in 1917 and served until the end of the war. On November 12th, 1919, with his brother, Capt. Ross Smith (Keith was at that time a lieutenant), he set out from Hounslow in a Vickers Vimy to fly to Australia. The two brothers were accompanied by Sgt. W. H. Shiers and Sgt. J. M. Bennett. The distance of 11,130 miles was covered in 124 hours' flying time, the Vimy landing at Port Darwin on December 10th after an elapsed time of four weeks and two days. Thus, the Australian Government's prize of £10,000, offered for the first flight from England to the Commonwealth in thirty days or less, was won by a narrow margin. For their part in the flight Sir Keith and his brother were both knighted, and Sgts. Shiers and Bennett were promoted to commissioned rank.

A message from Australia states that Sir Keith died an embittered man because the historic Vimy which he had helped to crew had been removed from the National Museum in Canberra. Mr. Shiers (one of the former sergeants) is reported as saying, "The removal of the Vimy from the museum to an R.A.A.F. hangar, where it lies in bits and pieces, was an outrageous thing." He added that he intended to write to Mr. Robert Menzies, the Australian Prime Minister.

Mr. Shiers is now the sole survivor of the great flight.

Armstrong Siddeley Sales Appointment

Mr. Morris.

FORMERLY chief airworthiness engineer of Rolls-Royce, Mr. Geoffrey Morris has joined Armstrong Siddeley Motors, Coventry, as head of technical sales. Mr. Morris, who is 48, received his engineering training at Bristol University. He joined the Bristol Co. in 1928 as a technical assistant to the late Mr. H. C. Mansell, who was then head of the engine research department, working in particular on the development of the sleeve-valve engine. In 1934 Mr. Morris joined the aero division of Rolls-Royce, Ltd. He is an expert on fuels and lubricants and during the war was responsible for a number of important advances in this field. He was a member of one of the British teams sent to investigate German aero-engine factories in 1945. He has since represented the British aircraft industry at international conferences dealing with engine airworthiness, and he is chairman of the S.B.A.C. engine airworthiness panel.

DINED OUT recently, to mark his retirement from the R.A.F. at the end of the year, was Air Chief Marshal Sir Basil Embry. The occasion, depicted here, was arranged by the R.A.F./R.C.A.F. Dinner Club at H.Q. Allied Air Forces Central Europe. Left to right are Air Marshal H. P. Fraser (Chief of Staff), Cdr. R. C. Medley, R.N. (Chief of Staff, Allied Naval Forces Central Europe), Sir Basil Embry, and A. Cdre. Dickens (Joint President of the Club).

Globemaster/Workhorse Combination

NOW under study as a means of sending a highly mobile striking force to virtually any part of the world within a matter of hours is the aerial ferrying of Piasecki H-21 Workhorse twin-rotor helicopters by Douglas C-124 Globemasters. Tests made by the 516th Troop Carrier Group at Sewart A.F.B., Tennessee, show that the helicopter—the largest yet carried by air—can be dismantled in a few hours and stored in the Globemaster without need of overhead cranes or other heavy equipment. Maj-Gen. Chester E. McCarty, Commander of the 18th Air Force, U.S.A.F., has said of the operation: "Airlift of H-21s in C-124s permits utilization of the big rotary wing craft in remote areas where they have never flown before, delivery being made in hours instead of days. Our five squadrons of helicopters are now air transportable to any point in the world where they are needed by the speediest possible method of transportation."

On the Samlesbury Strength

A RECENT addition to the strength of the English Electric team of test pilots at Samlesbury, Lancs, is Mr. J. C. Hall. Part of his duties will consist in flying the company's private aircraft.

John Charles Hall has spent more than seven years in the Royal Air Force, and is a qualified flying instructor, having completed the course at C.F.S., Little Rissington, in 1953. He joined the R.A.F. in 1948 and gained his wings at Cottesmore, later going to the Middle East to a Spitfire squadron and subsequently flying Meteors. Before joining the Service he was an engineering trainee at Rolls-Royce, Ltd.

Mr. Hall is 27 years old, and is married; his wife was formerly an officer in the W.R.A.F.

SOUVENIR: A scale model of a Bristol Sycamore was recently presented by the Bristol Aeroplane Co., Ltd., to Lt-Cdr. D. F. Farquharson, R.N., who was appointed O.B.E. (Military Division) for his part in rescue operations in the New South Wales floods last February. Lt-Cdr. Farquharson is seen receiving the model from Mr. C. F. Uwins. On the left is Mr. Roger White-Smith, deputy sales manager, aircraft. Lt-Cdr. Farquharson saved 36 people from drowning.

TEST TANK Mk 2

Comet 2 in the de Havilland Tank at Hatfield

THE water tank is likely to be a prominent feature of the airliner-factory landscape—certainly in Britain if not in the U.S.A. also—until it has yielded sufficient information about the design of pressure cabins to render itself unnecessary. This is not likely to be for some years, despite the vast amount of research into fatigue already carried out by Government establishments and private firms. The aim, quite simply, is to evolve design principles which will yield structures that do not require to have their fatigue-proof properties demonstrated by costly and prolonged experiment.

The original "prototype" water tank was constructed by the R.A.E. in the spring of 1954, and the vital evidence it provided for the Comet 1 investigation has passed into history. As might be expected, the de Havilland company have now built their own tank at Hatfield, in which a Comet 2—actually the sixth production aircraft, modified and strengthened to R.A.F. Transport Command standards—made its first "flight" on Saturday, November 26th. Up to the present date about 1,000 applications of pressure, or cycles (it is logical to measure cabin fatigue life in "cycles" rather than hours), have been made, equivalent to 3,000 hr of flying if an average of three hours per flight for an R.A.F. Comet 2 is assumed. Normal cabin pressure of 8¼ lb/sq in, with simultaneous wing gust-loads, is applied every four minutes, with respite only for detailed examination every 500 cycles. This programme will continue 24 hours of the day until failure occurs, and even after a life beyond that likely to be achieved by R.A.F. Comet 2s is reached. This is certain to be not less than 4,000 to 5,000 hr, and probably more: assuming 3 hr as an average "cycle," this would require a test to, say, 1,700 × *x* cycles, where *x* is the all-important scatter-factor.

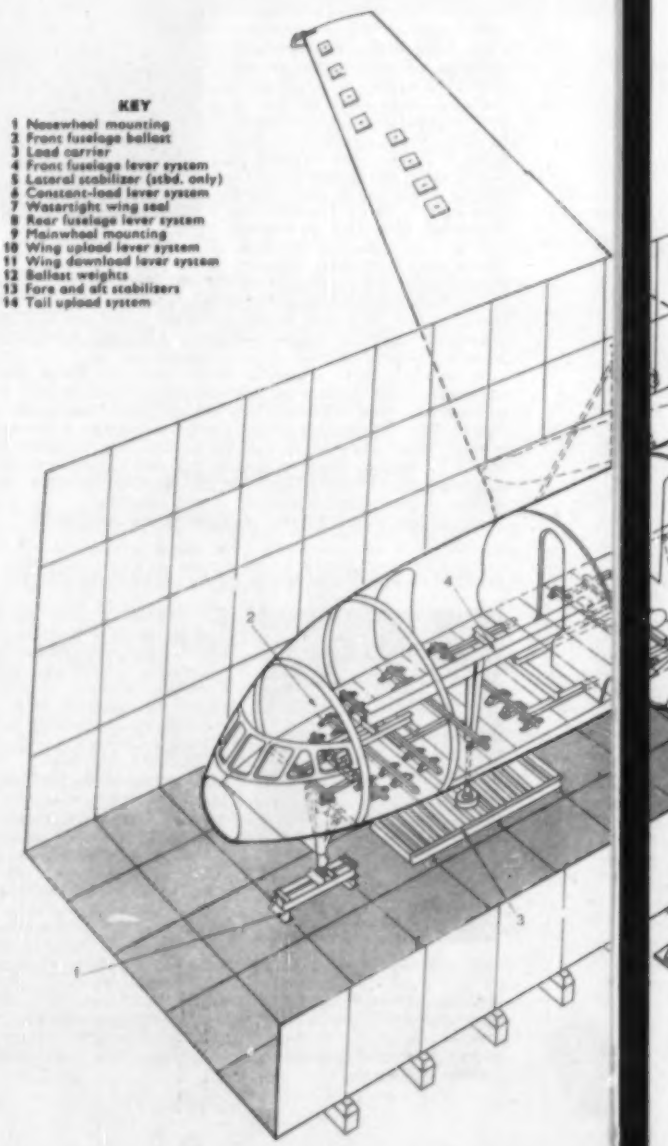
The Comet 2 in the tank incorporates modifications designed in the light of an intensive de Havilland test programme conducted during and since the Comet 1 investigation of 1954. The modifications include redesigned cabin windows, now heavily reinforced, oval-shaped cut-outs, involving the complete re-skinning—with heavier gauge material—of virtually the whole length of each side of the fuselage; reinforcement of all fuselage seams, joints, hatches, doors, etc.; and local reinforcing of the wing. Several thousand individual tests on components took place before the complete aircraft specimen was submitted to the final tribunal of the water tank.

The 220,000-gal tank measures 140ft by 20ft, including a separate 70,000-gal section to enable Comet 4 specimens to be tested concurrently with the Comet 2. The dividing wall can be removed for later tests of a complete Comet 4 specimen. The tank is emptied into an adjoining reservoir when the 500-cycle inspection is due. Construction—by bolted plates—is straightforward, except where the wings protrude; here the walls are recessed to facilitate inspection of wing rib 3, and are tailored to the local contour of the wing (which itself was modified to eliminate the sharp trailing edge). The seal of dinghy fabric was made and fitted by the R.A.E. As can be imagined, the up and down movement of this seal poses a fatigue problem of its own.

Fuselage and wing bending forces are applied by hydraulic rams and lever systems as shown in the illustration. Force applied to the wings is equivalent to a 10ft/sec gust, this being the value used by the R.A.E., based on Comet 1 flight velocity-

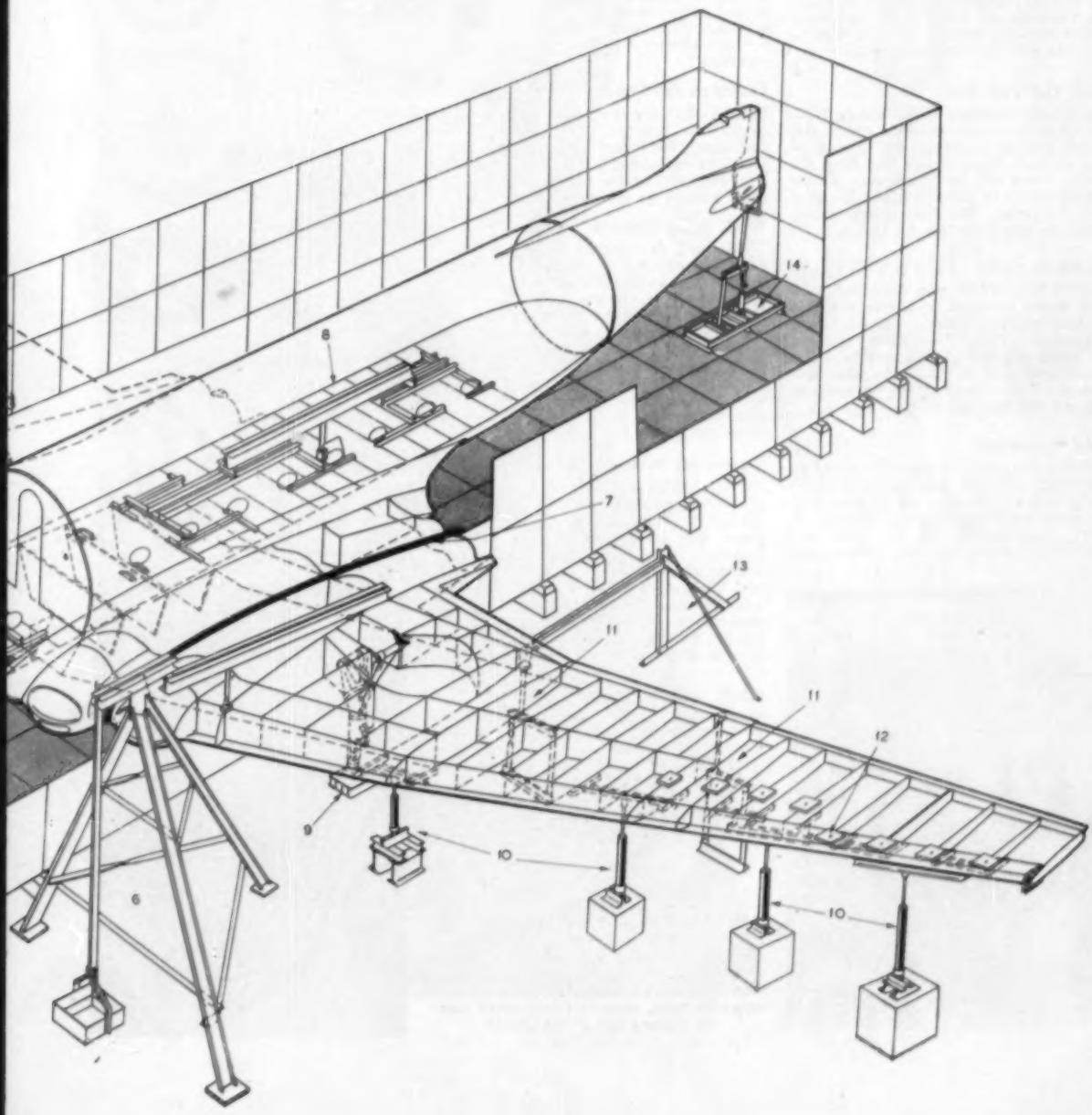
(*Concluded at foot of page* 981)

An aerial view of the Comet 2 in the de Havilland tank on the north-west side of Hatfield aerodrome.



The main control and pump room. The double row of lights on the small panel at the top left indicates the application of up-and-down wing gust loads, and a red light below comes on when the cabin is pressurized.

The wing-root seal is made of dinghy fabric, and is inflated by the head of water in the tank. A trough collects leakage through the wing structure. (Right) Conning tower: from the fin-stub protrudes a vent-pipe to evacuate air from the non-pressurized rear fuselage.



HERE AND THERE

SUPERSONIC SANTA? Intended to test the ejector-seat equipment of the Convair F-102A supersonic all-weather intercepter, but suggesting possibilities for next Christmas, is this rocket-propelled sled. Within five seconds of the system being fired the seat is jettisoned, the dummy pilot automatically separated from the seat and the parachute lanyard pulled.

New T.A.F.

VICENZA, Italy, will be the base for a new NATO Tactical Air Force to come into operation on January 1st next year. It will include Italian, French, Greek, American and Turkish personnel.

B-57s for Far East

TACTICAL bombers of the Martin B-57 type (American-built development of the English Electric Canberra) are to be supplied to the United States Far East Air Force. They will be based near Tokyo in replacement of piston-engined Douglas B-26 Invaders. The first consignments should by now have left the U.S.A.

An Avro Loss

A SHACKLETON was destroyed, and three others damaged, in a hangar fire at the Avro overhaul works at Langar, Notts, on December 17th. The aircraft burnt out was fitted with special test equipment and was due to leave for Malta the next day. Sabotage is not suspected; the fire occurred during a fuel-pressure test.

Cold Shoulder

RUSSIA has made a request for use of an Australian servicing base to be used by Soviet aircraft engaged on Antarctic research during the forthcoming Geophysical Year. Commenting on the claim, the *Adelaide Advertiser* says that if the request were granted Russian aircraft would doubtless be required to keep well away from the Woomera rocket range: "It would be absurd to pretend that Russian planes, whatever their ostensible mission, will be welcome visitors to Australia while the cold war lasts."

FIRST AND FOREMOST: America's first woman pilot was Mrs. Blanche Stuart Scott, seen here chatting with one of her country's foremost film actors, James Stewart. Mrs. Scott first flew an aeroplane on September 2nd, 1910, an event she is probably recalling for Jimmy's benefit—he himself being dressed for the part of Lindbergh in the film "The Spirit of St. Louis."

Down to the Show

PROVIDED adequate safeguards can be made to prevent the cattle being frightened, the judges at next year's Bedfordshire Agricultural Show are to arrive by helicopter, as an added attraction to draw visitors to the show.

W/C. J. D. Hewett

THE death is reported of W/C. James Duff Hewett, A.F.C., R.N.Z.A.F. (Rtd.) at his home in Northland, New Zealand, at the age of 64. He was one of New Zealand's leading aviation personalities in the 1930s, when he was managing director of Falcon Airways, Ltd., of Auckland. An R.F.C. pilot (Nos. 4 and 23 Squadrons) in the First World War, he was decorated with the Croix de Guerre with palm. After the war he put in a year with No. 20 Squadron on the North West Frontier.

Technical Writers' Association

ESTABLISHED a little over a year ago as a non-profit-making organization, the Technical Publications Association reports that its membership is growing steadily. It exists to promote the interchange of ideas between technical writers and illustrators engaged in industry. In addition to circulating a newsletter, the Association arranges meetings at which experts discuss various aspects of publication work, and visits are arranged to printers, process engravers and other establishments of appropriate interest. One of the aims is to establish recognized courses, and steps are being taken towards collaboration with educational authorities, including the City and Guilds of London Institute, with a view towards the establishment of examinations. The T.P.A.'s offices are at 46 Brook Street, London, W.1.

TAILS FOR MAD BIRDS: In the U.S. Navy the name MAD-bird is applied to the Lockheed Neptune equipped with the magnetic anomaly detector, to seek out submerged submarines. The detectors are housed in these huge non-magnetic cones, some 14ft long, which form the extreme tail of the aircraft.

More Norwegian Aluminium

THE Industrial Affairs Committee of the Norwegian Parliament has approved plans for increasing aluminium production at the State-owned Ardal plant, West Norway, by 36,000 tons, to reach 62,000 tons a year. The cost, including the development of hydro-electric power, is estimated at £19,700,000, and a United States loan of 20,000,000 dollars is envisaged to meet part of the cost.

S.L.A.E. Prizewinners

THE Society of Licensed Aircraft Engineers announces the award of its prizes to successful candidates in the May examinations, in aircraft servicing and maintenance, conducted by the City and Guilds of London Institute. In the intermediate category, I. J. Ford (aircraft artificer, R.N.) was successful, and, in the final, R. Bell (engineering apprentice, Royal Aircraft Establishment). Both took airframes as their specialist subject.

HUNTER F1, F4 AND F6

HUNTER TRAINER

SWIFT

SUPERMARINE N113

DE HAVILLAND 110

COMMONWEALTH SABRE

LANSEN

DRAKEN

MYSTERE IVB AND IVN

SUPER MYSTERE

CANBERRA

VALIANT

VAUTOUR

COMET 2, 3 AND 4

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Twenty-five years of distinguished service, including two wars, have gained for No. 201 Sqn. the standard illustrated (right). It was presented (below) by Air Chief Marshal Sir Arthur Longmore at a parade at the squadron's base at Pembroke Dock on December 16th.

A STANDARD FOR No. 201 SQN.

A Flying-boat Unit Honoured

ON December 16th No. 201 Sqn. received its standard from Air Chief Marshal Sir Arthur Longmore, G.C.B., D.S.O., who was the squadron's first commanding officer, at a parade at its base at Pembroke Dock, South Wales. During its long existence, dating from October 1914, the squadron has built up a record of achievements which fully justifies its pride of place as the first squadron in the Royal Naval Air Service. The battle honours selected to appear on the squadron standard are Western Front 1915-1918, Arras, Ypres 1917, Somme 1918, Norway 1940, Atlantic 1941-1945, Bismarck and Normandy 1944.

Detailed histories of this famous unit appeared in *Flight* in 1934, 1944, and 1952, but a summary of its achievements is not out of place on the occasion of the presentation of the standard. The present number, 201, shows that it was one of the R.N.A.S. squadrons incorporated into the R.A.F. on its formation in April 1918. It had, indeed, started life as No. 1 Sqn., R.N.A.S., and had performed valuable work from October 1914 onwards. Members of the squadron destroyed two Zeppelins, one of them (LZ.37) by bombing it in full flight. They had shared in the first instance of damage to a U-boat by aircraft at Zeebrugge and, in August 1915, they had for the first time destroyed a U-boat at sea by bombing. But No. 1 Sqn. became No. 1 Wing with "A" and "B" Sqns. including flights of fighters, reconnaissance aircraft and bombers. "A" Sqn. was detached and finally was once more named No. 1 Sqn. when it flew in support of the Army in December 1916. In those early years its tasks were many and its equipment included Bristol Scouts, Wights, Avro 504s, Sopwiths, Vickers, Curtiss Jennies, Bleriots, Maurice Farman seaplanes, Morane Caudrons, Nieuport two-seaters, B.E.2Cs, Sopwith Triplanes and Camels. The last two types it retained from 1916 until its disbandment on December 31st, 1919.

For 10 years the squadron number lapsed until, in 1929, No. 480 (Coastal Reconnaissance) Flight, stationed at Calshot on the Solent, was renamed No. 201 (Flying Boat) Sqn. and equipped with Southampton Mk. IIs. The routine of peacetime continuation training began, but was relieved, as is always the case with flying-boats, by a rather greater proportion of interesting assignments than usual. Already the flying-boat had the versatility and the flexibility of operation which make its threatened disappearance now so unfortunate. In June 1937, for example, the squadron was able to fly four nursing sisters non-stop from England to Gibraltar to assist in caring for wounded from the German battleship *Deutschland* which had been damaged off Spain.

At this time new equipment arrived in the form of Saro Londons and the unit was based at Long Hope in the Orkneys. The gathering storm of World War II caused a move in September 1938 to the squadron's war station at Invergordon, but the more peaceful associations continued when, in May the following year, the squadron was affiliated to the Island of Guernsey. The flying-boat crews are cheerful and resourceful, combining as they do the skills and arts of the sailor and the airman, and flying-boat people seem to make good friends. While the Guernsey affiliation, therefore, has been maintained ever since, a very strong bond of friendship was forged with the inhabitants of Lerwick more recently. After all, a better ambassadorial aerodyne than a large flying-boat has yet to be developed.

In June 1939 the Londons moved again, this time to Sullom Voe and began regular patrols over the North Sea. The squadron is proud of the fact that the long and arduous hours of anti-submarine patrolling, which constituted its not insignificant contribution to the war effort, included some of the first operational flights of the war and the last operational anti-submarine patrol. Two Londons were on patrol at 1100 hr on September 3rd when Britain declared war and, 20,000 flying hours later on June 3rd-4th, 1945, a Sunderland completed the last Coastal Command patrol of the war. Hostilities had, of course, ceased in Europe with V.E. Day on May 8th, but precautionary anti-submarine patrols were maintained for four weeks after that date. The first Sunderlands had arrived only in March 1940 and after that No. 201 Sqn. was successively issued with the Mk. 2, 3 and 5 versions and operated alternately from Pembroke Dock in South Wales and Castle Archdale in Northern Ireland. Altogether the squadron sank five U-boats and shared in the sinking of a sixth. Patrol work had been varied in May 1941 by the order to help in the shadowing of the German battleship *Bismarck* during the action which led to its destruction.

After the war, the squadron was not disbanded and it has since then continued as one of the few flying-boat units left in the R.A.F.

"Flight" photograph

A STANDARD FOR NO. 201 SQN. . . .

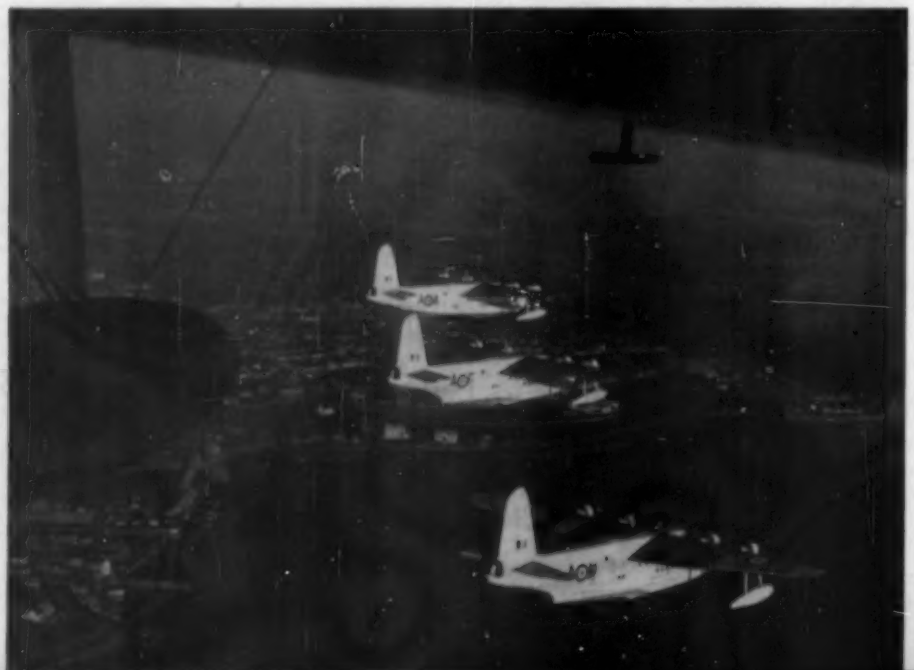
No one who has served in "boats" speaks ill of them, and though the strong claims of their supporters have not borne fruit in the form of a Sunderland replacement, boats have repeatedly demonstrated their unique qualities both as general-purpose aircraft and as potent anti-submarine weapons. Though for one reason and another no Sunderland replacement has been ordered in England, the United States Navy has not ceased active development of the type for a number of operational rôles.

The latest transatlantic enterprise is, of course, the Martin P6M swept-wing, jet propelled flying-boat, which is designed to operate either as a minelayer or photographic reconnaissance machine. It incorporates the results of an extensive programme of research on flying-boat hull shapes which has resulted in water-borne characteristics far in advance of those of boats of the Sunderland's vintage. Admiral of the Fleet Earl Mountbatten of Burma, saw the P6M during a recent visit to the United States, and the influence of this project on English thinking will be awaited with great interest. The United States Navy has also for many years operated the Martin Mars transport flying-boats between California and Honolulu, and for these also a replacement has emerged in the form of the turboprop-powered Convair R3Y Tradewind. This particular machine, in later versions, is designed to be able to disgorge its cargo directly on to any beach negotiable by landing craft and has a self-contained cargo ramp in the nose and reversing airscrews which make it largely independent of shore facilities.

It is well known that R.A.F. thinking on overses patrol work is based on the land-based aircraft, and one cannot help feeling that the days of the small number of flying-boats remaining in service are numbered, if only because nothing is at the moment being done to provide a replacement despite the fact that a complete design is in existence. Yet the boat squadrons are convinced that the Sunderland can do anything the Shackleton can while providing a standard of comfort quite unattainable in a practical land-based aircraft. Furthermore, they have proved by their achievements since the war that even the Sunderland, which is basically a military aircraft, will serve relatively efficiently as a transport and, above all, provides a flexibility of operation quite unattainable by any other aircraft. By flexibility is meant the capability to work in areas where runways are not necessarily in existence. A particular example occurred when, during the war, German submarines began to sink ships in convoy *en route* to South Africa. A flying-boat squadron was immediately sent to a point on the coast to begin operations. With nothing but an area of relatively sheltered water and a number of marine craft for support, it began patrols, and sinkings were immediately drastically reduced. The peace-time equivalent of this operation was the use of Sunderlands—they were, in 1953, the five machines of No. 201 Sqn.—to fly supplies to the British North Greenland Expedition on the shores of Britannia Lake. They flew from Pembroke Dock, *via* Rejkjavik to Young Sound whence they moved 70 tons of assorted stores to Britannia Lake. This was obviously an operation which in the time could have been performed by no other aircraft.

But here an incident occurred which illustrates another facet of flying-boat operations. The crew of each aircraft approaches more closely to its nautical equivalent than in any other branch of the Air Force. The peculiar conditions of operation from water mean that the crew takes a very large part in routine servicing and usually a boat is flown by only one crew. They carry out their own refuelling, keep the aircraft clean, look after it in many ways and get to know it well. In rough weather they stand by it and, if necessary, live on board. They therefore take a pride in their boat and, consequently, they become strongly attached to it and know a great deal about it. When, therefore, the Sunderland "C" Charlie was forced aground by wind and threatening ice floes on Britannia Lake, the crew set about salvaging the aircraft themselves. In three days of continuous work, helped by members of the expedition which they were supplying, they managed to refloat the aircraft despite a steady falling of the water level in the lake. They applied a specially prepared canvas mat like a bandage to the underside of the hull, secured it with ropes and forced it into place with an inflated dinghy. Motor-driven and hand pumps were kept going all the time until as many of the holes as could be found had been plugged with combinations of chewing gum, mastic and half a ton of cement. The cement was in fact mixed on the floor of the bomb room before being applied to the damaged section of the hull. Anxious hours passed as the now almost exhausted crew waited to see if the concrete would set in the bitter cold; and all the time the pumping operations continued with the aid of a hand pump which had to be perpetually dismantled and cleaned after the motor-driven pump had finally seized. The aircraft was at last brought to a flyable condition despite the fact that the water level in the forward bilges had never dropped low enough for the salvage workers to be able to see directly the damage they were trying to repair. The bandages were removed and, with water spurting in under the pressure of the take-off run "C" Charlie finally got airborne from Britannia Lake and flew as quickly as possible to the M.U. on Wig Bay in Scotland. Repairs had been continued in the air.

Another operation carried out by No. 201 Squadron was their



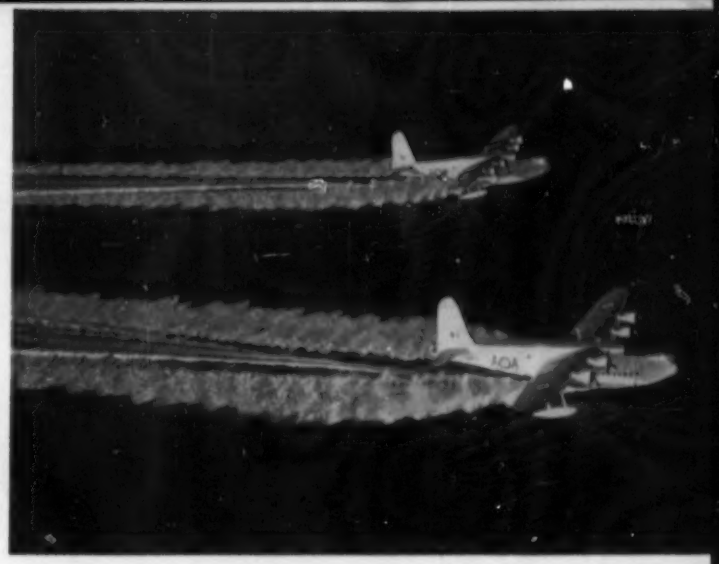
(Top) Like everyone who has served in flying-boats, S/L. D. W. Bedford, Commander of No. 201 Sqn., and G/C. P. A. Lombard, Station Commander at Pembroke Dock, are both enthusiastic about the qualities of such aircraft. Though the Sunderland might seem unwieldy, No. 201 Squadron showed that formation flying (right) was well within their capabilities.

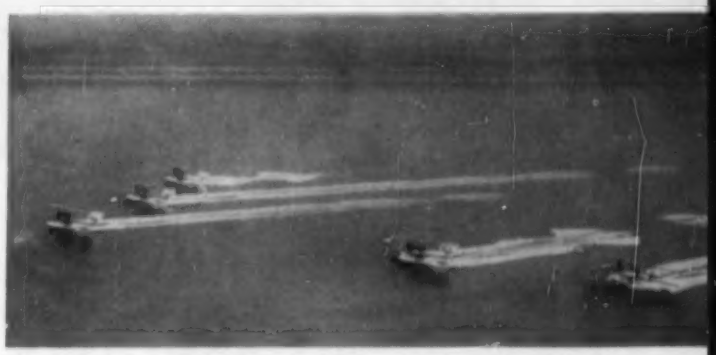
"Flight" photograph

participation in the Berlin Airlift between July and December 1948. Operating from a base on the Elbe near Hamburg they carried no less than 3,000 tons of salt, potatoes and other commodities to Lake Havel in Berlin. It is remarkable that an aircraft fitted for oversea anti-submarine patrol should also be capable in this way of carrying quantities of freight.

A goodly number of interesting journeys have fallen to the squadron's lot in recent times, including trips to the Channel Isles and to Scotland. The squadron operated from Malta for a time last year, and also assisted in relief work after the great Greek earthquake. More pleasant, they were invited to take part in the Battle of Britain celebrations at Lerwick this year, since they had been the first squadron to operate during World War II from Sullom Voe. They had also attended, in January, the traditional celebrations of Up Helly Aa there, and struck up a friendship with the people of the town which is commemorated by a message from the Sheriff of Lerwick written on the wall of the wardroom of one of the Sunderlands and now carefully preserved. During Exercises Springboard, Tide Rip and New Moon, No. 201 Squadron got to know many of the ships they worked for and against, and this year they adopted the submarine H.M.S. *Springer*.

The standard of comfort in the Sunderlands is high, and since the cooking facilities and wardroom are well equipped and spacious, flying-boat crews become adept at cooking and generally looking after themselves. A full range of crockery is carried in an enormous "tuck box" in each aircraft, together with the food issued for each long flight and the delicacies bought by the crew themselves to supplement their diet. In cold weather when there is a prospect of many hours airborne and yet more hours on the water refuelling after flight, such facilities become virtually a necessity; yet, as the Sunderland makes its stately pass over the Service airfield during Battle of Britain celebrations one always imagines that, drifting from the waist gun hatch will be the delicate aroma of a juicy steak, and that some of the crew will be sitting at table enjoying a meal. It is a fact, however, that for this apparent luxury, the crews work hard and long.





Formation landing is an impressive exercise in flying-boats, and though not normally practised, the two views of No. 201 Sqn. aircraft were secured (top) with Sunderlands at Pembroke Dock recently, and (below) with Southampton IIs at Calshot in November 1933.
"Flight" photographs

A CLASSIC WORK OF REFERENCE

"Jane's All the World's Aircraft, 1955-56," compiled and edited by Leonard Bridgman. Sampson Low, Marston and Co., Ltd., 25 Gilbert Street, London, W.1. Illustrated. £4 4s.

THE introduction of a feature on guided missiles in this latest edition of *Jane's* acknowledges another of the major revolutions that have, through the years, changed the whole pattern of aircraft progress. Thumbing through the editions of the mid-'thirties, one can see the steady triumph of monoplane over biplane. Ten years later, the first jet-fighters appeared and year by year since then turbine-powered aircraft have demanded a higher proportion of the pages of this unrivalled aviation annual.

This year, the missiles are given only six pages to themselves, plus, in a few cases, a standard type of write-up under their manufacturers' name in the main section of the book. In the 1956-57 edition, they will demand more attention, and still more in the following year. Other developments also can be foreseen, for there are references to work on nuclear engines and nuclear-powered aircraft in the entries for many U.S. companies, including Boeing General Electric, Lockheed, Martin and North American. Fairchild are said to be experimenting with "several unique types of powerplant" and there is an interesting reference to new "underwater rocket devices" being developed by the Aerojet-General Corporation.

In general, *Jane's* is bigger and better than ever this year, with 30 more pages, bringing the total to 410, and an invaluable index listing all types dealt with in the last ten editions. Of the 724 illustrations in the aircraft section, 55 per cent are new, including a number of "scoops." Unfortunately, the British section is the poorest in this respect, because certain of our aircraft builders are still not sufficiently publicity-conscious to provide new and up-to-date pictures of their products each year.

The Soviet section is considerably better than before, with fewer suspect types and including Aviation Day Fly-past pictures of the new Russian twin-jet night fighters, and the newest bombers.

A feature that should not be overlooked is Mr. Bridgman's preface, which gives a masterly and concise review of current aviation activities and trends, and can be regarded as a kind of stop-press late news page. The growth of commercial aviation has never been expressed better than in his comment that "the tempo of air transport now averages a scheduled take-off somewhere in the world every five seconds of the day and night."

The usual introductory features are retained, with several amendments to the diagrams of national air force markings, to keep them up-to-date and comprehensive. The page of international civil aircraft markings is complete except for the recently allocated "3W" for Vietnam; and the value of the airline data has been increased by including statistics on non-scheduled, as well as scheduled operations.

Only United States blimps are shown in the Airships section, which is as it should be, for only Goodyear are currently building lighter-than-air craft. But the exclusion of all but U.S. weapons in the table of guided missiles should be remedied, as should the reference to "a casual experiment in 1918" being the start of guided-missile development, which ignores the pioneer work done at Farnborough two years earlier.

PRICE MAINTENANCE EXAMINED

THE topical subject of resale price maintenance is very fully discussed in a newly published book.* No one engaged on the sales side of industry or the distributive trades, and no executive of a trade association, can permit a gap in his knowledge of the general and legal basis for resale price maintenance. The economist and lawyer will welcome additional information upon how modern distributive methods interact with current concepts of monopoly, of restraint of trade, patent rights and the like.

The author, Mr. K. C. Johnson-Davies, has dealt with the subject in a clear and invigorating way. A barrister-at-law, he has been chief executive of the British Motor Trade Association for over twenty years. Whilst drawing widely from his experience in the motor industry, he presents a comprehensive picture of the general law governing the powers and limitations of trade associations in the enforcement of collective agreements, the constitution of domestic tribunals and their position in law.

**"The Practice of Price Maintenance (with particular reference to the Motor Industry)," by K. C. Johnson-Davies, M.A. (Cantab.), T.D., Barrister-at-Law. Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 15s.*

TWO-DIMENSIONAL FLIGHT?

Over-controlled Airline Routes

By CAPTAIN H. L. LEE

WHATEVER may be the eventual solution to the problem of flight separation, many airline pilots are concerned at the present tendency to reduce all routes, whether busy or not, to the status of so-called airways, thus abandoning one of the three dimensions. It is certainly ironic that, so soon after the invention of the aeroplane, with its unique ability to proceed direct between two points, it should apparently become impossible to fly other than by a series of zig-zag tracks. The economic effect is immense; over Europe alone, airways flight costs operators thousands of pounds a day because of extra mileage flown, quite apart from the cost of the ground organization. But I have yet to see a word in print supporting the view held by many: namely, that some of this money is not merely wasted—it actually achieves more harm than good.

Let me hasten to assert that some airways are necessary and essential. They are, at present, the practical method of channelling aircraft in and out of airfields, and of avoiding prohibited zones. In a congested area such as Southern England, provided that the elaborate and expensive ground organization and equipment are operating efficiently, they can provide the answer to the question of separation. But the present tendency is to select two remote African or Asian towns a thousand miles apart, site two or three beacons somewhere between them, and call it an advisory route; it is then expected of the pilot that he will overfly the beacons, greatly increasing air-space congestion. This, it seems, is considered preferable to allowing aircraft to spread out as they naturally would, perhaps a hundred miles apart laterally at the midpoint. Let me emphasize that my objection is not to the ground information service—which may perhaps warn me that I am overtaking an aircraft at the same altitude—but to the routing, which greatly increases traffic density.

The establishment of advisory routes is at present often governed by the existence of radio beacons. These seldom exist on the direct track but are normally some miles to one side or the other; they are usually sited at airfields and the airfields are there because of centres of population. Thus an aircraft which might otherwise be flying over open sea, or desert, with a small risk of meeting another aircraft, will often be guided into overflying a number of busy airfields, with all the attendant risk of collision. Furthermore, the weather may be worse, for towns often owe their existence to the fact that their sites have a good rainfall.

Risks of Failure

Now, if these routes were airways, and conditions perfect, there would be justification for this system of routing. But airways, with their elaborate equipment of beacons, ranges, fan markers, multi-channel voice frequencies, and radar coverage, are few and far between. And, even then, a fully equipped airway is subject to failures. Radio congestion is sometimes so bad that minutes may pass before one can report passing a check point. Controllers are fallible; so are pilots, altimeters, and transmissions of altimeter settings; whilst every patch of bad weather reduces the efficiency of the organization. In fact, really severe frontal weather, at the very time when separation is most wanted, can put a complete airways system out of action.

In actual fact the majority of these routes are advisory, defined by I.C.A.O. as routes "within an F.I.R. along which air traffic advisory service is available." It is perhaps the most unsatisfactory type of "control" which has ever been experienced by pilots. Whilst adding greatly to the work of flying, communicating and navigating, it relieves the pilot of no responsibility at all. When I narrowly escaped a head-on collision whilst on an A.D.R. over Surrey, I was given the perfectly legitimate excuse that the ground control is only operating in an "advisory" capacity. In England, of course, the system is most efficiently run, but the same is not always true abroad. Some countries allow V.F.R. flight at night time; some have as check points "abeam" beacons which may be 30 miles away, despite the fact that "abeam" to an aircraft going north may be some miles south of aircraft going the other way; some abandon quadrantal separation; and all the time that one is coping with the extra work involved in A.D.R. flying, other aircraft are passing alarmingly close above or below.

Let me now make a few provocative suggestions as to why advisory routes are being increased, and the greater air-space congestion ignored. Firstly, when you have aeronautical planners one naturally expects them to plan something. I have no intention of belittling the vast amount of valuable planning which has made airline flying so much safer and sometimes easier. But sometimes it appears misguided. For example, the Kibbeck Romeo phonetic alphabet, which has caused endless confusion for several years, was apparently introduced without being wanted by either of the two groups of people it could possibly concern, the pilots and ground controllers. Or again, although I have never yet heard of anyone confusing "Yes" for "No," I have heard confusion between the much longer "Affirmative" and "Negative," which is the recommended method of replying. To my mind, it is a similar misguided enthusiasm to introduce something new which accounts for the increase in advisory routes.

Secondly, A.D.R.s look right—at any rate to those people who have a tidy mind. They look right in just the same way that a group of guardsmen look better than a group of commandos. And a great many people in aviation have got tidy minds. Let me digress to give a couple of examples. The use of five-letter registrations and call-signs for aircraft offers about ten million alternatives, without starting to introduce numbers as well. Yet, because of the tidy way in which registrations are issued, partial confusion often exists. The other day the aircraft which took off ahead of me at London Airport had only the last letter different from mine, while the one behind me had only the third letter different. Another aircraft not far behind had the last two letters the same. Or again, the use of three-letter call-signs for radio facilities offers over 15,000 alternatives; it should be simple to allocate call-signs so that nearby beacons cannot be confused. Yet look at any facility chart and you will find clusters such as FNL, FNC, FND, FNO, etc., close together. The tidy distribution may even apply to frequencies as well, for FNC 324 Kc/s is well within hearing distance of FN 326 Kc/s. Anyone who in turbulent weather has tried to identify one of the two Rebecca blips whose coding differs only in the transposition of a dot and a dash will have mentally cursed the system.

Three-dimensional Thought?

Thirdly, I feel that people do not stop to think critically of the development. Perhaps they automatically think changes mean progress. The name "airways" sounds right; after all, they came from the U.S.A., even if the situation has changed radically since they were inaugurated. One takes them for granted, like met. forecasting. Yet—to digress for the last time—forecasting itself should not be taken for granted. As long as seven years ago Francis Chichester gave before the Institute of Navigation a paper entitled *Is Forecasting Necessary?* He showed that modern aircraft were making weather forecasting outmoded. If forecasts were certain to be accurate, they would still be of only limited assistance. As they are sometimes completely wrong, their value is a matter for discussion. A fresh and unbiased consideration of both forecasting and A.D.R. flight would be of value.

I must, in conclusion, offer my alternative to A.D.R. flight. Airways I accept as inevitable though highly over-rated in value; it is A.D.R.s to which I object. My immediate solution would be to train controllers in three-dimensional thought; the ultimate solution, I suspect, lies in a system of grid separation which will need better facilities than are at present always available or made use of. Until then, I would urge a serious reconsideration of all schemes which introduce new advisory routes.

GERMAN INDUSTRY AND FRENCH PLAN

A RECENT article in *Flugwelt* says that concern is felt over a French plan which, as seen by Germany's aircraft industry, is for an association of European producers, involving the allotment of research orders and the commissioning of the building of prototypes and production models. A condition of the French proposal is believed to have been the limitation for a period of five years of Federal German construction of turbojets of over 4,000 lb thrust.

It is feared—writes a correspondent—that the formation of such an association would result in virtually no orders being placed with German firms, ostensibly on the grounds that most of the firms would have so much leeway to make up before they could start. So far only one contract has been signed: with Messerschmitt for the building under licence of the French Fouga Magister jet trainer. But orders from the Defence Ministry have still to come, even for this. So far the West German Government has given no indication that it opposes the alleged French scheme.

search–

strike!

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On the 21st September, 1955 a normal intake of 18 Royal Air Force Cadets, commenced flying training on the JET PROVOST at No. 2 Flying Training School, R.A.F. Hullavington.

Of the 18 Pupils 12 had had no previous flying experience whatsoever.

All 18 Cadets had flown solo by the end of October after dual instruction averaging 10 hours 35 minutes; of the 12 without previous experience the first pupil flew solo after 8 hours 20 minutes instruction, the average for this group being 11 hours 15 minutes.

That ab initio flying training on a turbo-jet powered aircraft is practicable, has been amply proved by the JET PROVOST — an aircraft capable of 300 m.p.h. in level flight yet docile and safe for the pupil.

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The helicopter is the Czech-designed-and-built H.C.2, a note concerning which appears on this page. The Lockheed Lightning, photographed recently at Blackbushe when returning to the U.S.A. from a Middle East assignment, belongs to World Wide Surveys, Inc. This is almost certainly the first Lightning seen in this country since about 1946.

AIRCRAFT INTELLIGENCE

Great Britain

Scottish Aviation Twin Pioneer. Registrations G-AOEN, O, P and R have been allocated to the second, third, fourth and fifth Scottish Aviation Twin Pioneers. The first Twin Pioneer is registered G-ANTP.

U.S.A.

Martin XP6M-1 SeaMaster. The SeaMaster prototype which crashed recently, killing three Martin employees and a U.S. Navy officer, had flown for more than 50 hr since its completion. It was the first prototype and the flight trials will now proceed with the second machine.

Lockheed C-130 Hercules. About 20 of these turboprop assault transports have now been completed and production rate is being advanced to six machines a month.

McDonnell XV-1. The second prototype of this convertiplane is now flying and differs from the first in the design of the rotor hub and skids, and in having fewer windows.

Piasecki YH-16A. A maximum speed of 166 m.p.h. has been attained by this, the world's largest helicopter. This figure is 10 m.p.h. above that achieved by the Sikorsky XH-39, which holds the official helicopter speed record. The YH-16A has now completed more than 20 hours' flying.

Boeing B-52D. The foregoing designation applies to the version of the B-52 Stratofortress bomber as now in production at Wichita. Gross weight has been increased to 400,000 lb and the drop tanks are of larger capacity. The designation B-52C applies to the Seattle-built version.

U.S.A.F. Bombers. Mr. Donald A. Quarles, U.S. Air Force Secretary, declared recently that America was superior in the number and variety of atomic weapons and the aircraft required to deliver them. Of the Convair B-58 supersonic bomber—the Hustler—he said, "We are very much interested in it but will reserve judgment until we know more about it."

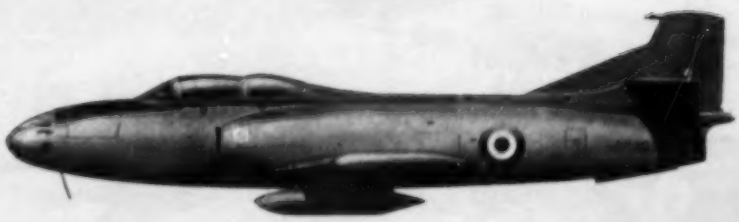
France

S.E. 2010 Armagnac. M. Crouzier, Secretary of State for Defence and Armed Forces, lately signed a contract concerning the seven Armagnacs. As a result, SAGETA, which has been operating the machines on behalf of the Government on the Indo-China run, is authorized to charter them to other operators "in order to cover the growing volume of air transport." The qualities of the Armagnac (a 91-seater) have been amply demonstrated during lengthy service on the Indo-China route (130 flights, totalling 1,200 flying hours).

Czechoslovakia

H.C.2 Helicopter. Illustrated on this page is the H.C.2 ultra-light helicopter, powered by a Praga D engine of 80 h.p., which gives it a speed of 80 m.p.h. and a ceiling of 10,000ft. The second seat can be removed to make room for freight or a stretcher. The designer responsible is J. Siechta, of the Central Bohemian Machine Works.

FIAT G.82
(Rolls-Royce Nene 2/21)
Span 38ft 1in
Length 42ft 5in



BUILDING A RADAR CHAIN

Canadian Defence Minister Describes the Construction of the Mid-Canada Line

A DESCRIPTION of one of North America's early warning radar systems, considerably more informative than any we have yet seen, was given recently in an Ottawa address by the Hon. Ralph Campney, Canadian Minister of National Defence. He was telling an audience from the Royal Canadian Army Pay Corps Association the story of the construction of the Mid-Canada Line.

Mr. Campney began by outlining the four main elements of the integrated system. These were:

First, the Pinetree System, which tied in to the Canadian and United States air defence commands a basic radar warning and control system and, through extensive communication networks, linked up the Canadian and United States air intercepter forces.

Second, the Mid-Canada Line, an early warning line supplementing the Pinetree Chain.

Third, the Distant Early Warning or DEWline, across the most northerly practicable part of North America.

Fourth, extensions down both flanks of the continent to prevent out-flanking of the transcontinental network by hostile aircraft.

Planning of the system [continued Mr. Campney] started some years ago, as soon as the thermo-nuclear threat began to take shape. It was realized at once that effective defensive steps to meet this threat would require the combined effort of both countries, that it would be costly and that its construction would be difficult.

Construction of the Pinetree radar system was tackled first. Part of it was constructed by Canada and part by the United States. In October 1953, when the Pinetree system was becoming operational, a group of Canada-United States scientists and military advisers recommended that additional early-warning capacity should be provided. After further consideration by the Chiefs of Staff of both countries, recommendations were made which led to the acceptance by Canada of the responsibility for financing, constructing and operating the Mid-Canada Line, while the United States undertook to construct the DEWline, with Canada contributing such resources and assistance as could be made available. The United States also became responsible for the seaward extension down each flank of the continent.

As the work on the DEWline goes ahead [continued Mr. Campney] Canada has been able to help in many practical ways. Valuable assistance has been given to United States authorities by aircraft and ships of the R.C.A.F. and R.C.N. respectively and the Canadian Army, too, has helped out, especially through its base at Churchill, Manitoba. The Departments of Northern Affairs and National Resources and Transport have also assisted and Canadian civilian air operators, contractors and industry generally have undertaken a good deal of the work in connection with specific DEWline sites.

Coming now to the Mid-Canada Line itself, this line is being constructed roughly along the 55th parallel and is a job fraught with great difficulties and new problems and accompanied by a good deal of hardship and discomfort.

For reasons of national and NATO security it will still be a good while before the full construction stories of the DEWline and Mid-Canada Line can be unfolded in all their gripping, challenging detail of risk, improvization and achievement. It is, however, already clear that these two achievements—as construction feats alone—will have an impact on the development of the Canadian North commensurate with that which the building of the transcontinental railway lines at the turn of the century had on the opening up of the West.

An approximate idea of the scope of the job may be formed from the fact that early this year it was estimated that about 170 million dollars would be required to provide the basic elements for getting the line into operation. That is enough money to build brand new modern housing along one side of a street well over 100 miles long. Over 1,200 men were at work on the line soon after it started and, as the project goes forward thousands of others are being employed across the country in workshops and in industrial and electronic plants.

Technically, the Mid-Canada Line consists of a series of unit detection and warning stations with main stations at appropriate intervals extending from the Labrador coast westward. The unit detection stations will use equipment originally devised by a research team sponsored jointly by the Defence Research Board and McGill University—hence the term sometimes used to describe it—"McGill fence." This equipment is of an advanced type and, in addition to its demonstrated performance, it requires a minimum of attention and is much less expensive than previously known types.

A typical main station will consist of an administrative and operation building, personnel accommodation buildings, supply buildings, boiler and powerplants, provision for inflammable stores, a garage and a hangar. All stations will have landing facilities for helicopters. Main stations will have special functions in relation to adjacent sections of the line, both as regards personnel and maintenance. Throughout the full extent of the line a multi-channel communications network is being built and appropriate air-ground-air communication facilities are being provided.

The initial responsibility for planning and for developing the overall requirements to bring the line to an operational state was given to the Royal Canadian Air Force. To take over the planning from the stage where the Canada/United States team left off, a special section was set up in the R.C.A.F. known as the Systems Engineering Group. This section assumed the responsibility for supervising the surveys and siting and for drawing up specifications in collaboration with the Defence Research Board, to enable work to be started.

Aircraft of the R.C.A.F.'s No. 408 Photographic Squadron, with some assistance from civilian operators, carried out nearly 8,000 miles of aerial photography and the photographing and mapping facilities of the R.C.A.F. and the Canadian Army Survey Branch were extensively used in planning the basic route of the line.

While all this was going on, the Department of Defence Production was studying the best means of constructing the line speedily and efficiently. In view of the nature of the project it was decided to utilize the resources of the Trans-Canada Telephone System to manage all phases of the construction operation. Trans-Canada designated the Bell Telephone Company of Canada to act as management contractor for them and a "special project division" of Bell was formed to carry out the task.

On the construction side, Defence Construction, Ltd., is responsible, working in conjunction with the management con-

Though his lecture mainly concerned the Mid-Canada Line, Mr. Compney made a number of references to the construction of the complementary DEWline, which forms the subject of these three pictures, showing typical scenes during the airlift of equipment. In the view at left, frames of graders form a foreground for two C-4s of the R.C.A.F.; in the small picture, material is being unloaded from one of them; and (above) Eskimos—whose labour is being employed in the construction of the chain—cluster round a C-119. Mr. Compney paid a tribute to the work of the R.C.A.F. and civil air operators.

tractor, for letting regional contracts to major contracting firms across Canada. These regional contractors in turn employ sub-contractors to carry out the bulk of the actual construction. Defence Construction and the management contractor also provide the technical staff for direct on-site supervision and installation of special equipment.

Through the Department of Defence Production, contracts, frequently running into millions, are being awarded to all branches of Canadian electrical and electronic industry and to industries supplying building materials. In many instances such contracts are concurrent with similar commitments to United States authorities in connection with their DEWline requirements.

Construction of the Mid-Canada Line involves many difficulties. These vary with the nature of the terrain. In the western provinces, where a certain degree of settlement has taken place, advantage can be taken of existing transportation facilities such as the railways to Dawson Creek and to Waterways and the airfield at Grand Prairie. In the Hudson's Bay and James Bay areas the railways to Fort Churchill and Moosonee are also available, as is water transport during the limited summer season. However, in much of this region muskeg abounds and the only practicable means of transportation—particularly for large amounts of heavy construction materials—is by tractor train during the winter months. A tractor train usually consists of one or two heavy caterpillar diesel tractors pulling up to twelve large sleds, called "wannigans." A tractor train must carry its own bunking and messing quarters, workshop and fuel supply, which cuts down materially the amount of freight which it can carry. A tractor train can travel about two miles an hour over sea ice near the shore or over land where the surface is not too uneven.

The most difficult type of terrain from the point of view of transportation is, of course, the rugged, deeply crevassed Quebec-Labrador area. Much of this area can be served only by air, as other means would take much too long and would eventually probably cost a good deal more. Knob Lake, with its air and rail facilities, is proving invaluable as a construction base for this area.

The types of buildings too, vary according to the region. In the western and Hudson's Bay regions prefabricated steel structures with interior fibreboard walls are being used, while in the Quebec-Labrador area, due to the prevalence of airlift as the means of transportation, light-weight prefabricated aluminium buildings will be installed.

The question of building foundations in the north presents many problems. In some areas ideal bases for buildings are provided by solid plateaux of ancient rock of the pre-Cambrian age. At such building sites, which are usually to be found where airlift of all materials is necessary, very little concrete is required for foundations, and the contractor's burden is lightened. But in other areas, where the top soil is deep and is subject to intense freeze-up and prolonged thawing, ordinary foundation construction procedure would be entirely ineffective. In such areas it has been found that pile construction must be used. The piles are sunk in holes made deep into the permafrost by high-pressure steam jets. Similar techniques are required for anchoring towers. Towers themselves, to withstand the rigours of the climate in many areas, must be provided with special de-icing equipment.

Construction under the circumstances which obtain in the sub-Arctic has required new and very carefully worked out logistical planning. Caches of aviation gasoline, fuel oils and lubricants, stores of food and large quantities of building materials have to be delivered to the points where they are required—well in advance of the time when they will be used and, in some cases, within a very short period when transportation is possible.

Some of the construction obstacles are less technical. At one of the locations in the Hudson's Bay region last August a field party found so many polar bears occupying the site that work could not be safely undertaken and had to be postponed for a time. Or again, towards the end of September, at the Knob Lake construction base, fire destroyed part of the contractor's camp, including fourteen temporary construction huts, kitchen and messing accommodation. Such a loss is a major upset to the timing of any contract. It is doubly so in the far north, even though no equipment or essential materials for building the line was involved.

Wear and tear on construction equipment and on air transport is, of course, very high. For example, experience has shown that out of approximately ten helicopters or fixed-wing aircraft on a job in the sub-Arctic not more than six or seven can be counted on as being serviceable at any given time.

To date, progress on this vast construction project, in spite of all the hazards and difficulties, has been maintained at the planned rates. There is no reason to believe thus far that the line will not be finished on time, though in a project of this type and magnitude new problems may intrude themselves at any time.

(Right) "The final approach . . . at 80-85 kt."

"Flight" photographs

HANDLING the HERALD

BY mid-November, six weeks after its first flight, the first prototype Handley Page Herald had logged 50 hr in the course of 58 flights. A candid appraisal of the handling characteristics of the aircraft during these initial trials, written by S/L. H. G. Hazelden, the company's chief test pilot, has now been made available.

As the following extracts will show, S/L. Hazelden's notes are exceptionally "quoteworthy" for two reasons: first, they give a very clear impression, from the pilot's viewpoint, of an important new transport aeroplane; second, he has not attempted to gloss over the fact that no new aircraft performs perfectly during its initial trials. On the contrary, S/L. Hazelden mentions a number of shortcomings and outlines the steps which will be taken to overcome them. Such frankness, one feels, is likely to enhance rather than detract from the favourable impression already created by this workmanlike aircraft. The substance of the report is given below:—

"The Herald has been taxied on both tarmac runways and on our grass airfield at Woodley . . . in crosswinds of 25 kt, gusting to over 40 kt. No difficulties have been experienced in taxying under any of these conditions. . . . Engine, brake and nosewheel steering controls make taxying easy provided the flying controls are locked. The flying control lock is positive and effective in action but at present needs rather more than a comfortable force to engage it. Taxying with flying controls unlocked is not recommended since it can give rise to unpleasant forces on the rudder bar and aileron wheel as well as rendering difficult the operation of the toe brake-pedals. Take-off with the controls locked is impossible, as the locking-lever limits throttle movement.

"At weights up to approximately 29,000 lb, only a moderate pull is required to unstick at speeds of 60-80 kt and when clear of the ground this force changes to a moderate push. Trimming is easy and positive and only small trim changes occur on retracting undercarriage and flaps. There is no tendency to swing when taking off into wind. The rudder becomes effective at speeds as low as 30 kt and can be used without difficulty to keep straight when taking off into crosswinds up to 20 kt.

"The distances to unstick have been about 300-400 yd."

Discussing asymmetric flight, S/L. Hazelden reports: "During climb-away using take-off power, the starboard outer engine has been suddenly throttled, before retracting the undercarriage or flaps, at speeds down to 75 kt; control has been satisfactorily maintained and the climb-away continued on the three remaining engines at this speed. Under these conditions the rudder was still rather heavy but this drawback is expected to be overcome by comparatively simple adjustments to the balance.

"With both starboard engines feathered and full climbing power (maximum continuous power) from both port engines, no difficulty was found in controlling the aeroplane at speeds down to 105 kt where it was possible to trim out all control forces in level flight.

Under these conditions turns of up to 45 deg bank can be made in both directions without difficulty.

"The aeroplane," S/L. Hazelden continues, "has a high degree of stability in all three planes. . . . There is, however, no tendency for 'wallowing' or 'Dutch rolling' in turbulent conditions, sometimes a feature of aeroplanes with a high degree of stability in the lateral and directional planes. . . . These stability characteristics make accurate trimming very easy and it is possible to fly 'hands and feet off' for considerable periods.

"When trimmed in a power-off glide approach, with undercarriage and flaps fully down, application of full take-off power to overshoot results in a very moderate pull force of about 15 lb in order to maintain speed at 85 kt.

"Changes in trim or stick force on retracting the undercarriage and flaps are small but there is a rather sudden nose-up change in attitude as the flaps retract from the fully-down to the take-off position. The suddenness of this attitude change will be alleviated by decreasing the present very rapid retraction time over this range of flap movement.

"For the first flights," S/L. Hazelden recalls, "the flying controls were purposely made heavy. In later flights they have been progressively lightened to achieve comfortable control forces. These steps have been completely successful for ailerons and elevator which are now very pleasant to handle; further development is proceeding on the rudder to achieve the desired force characteristics under all conditions. At present the footloads involved before retrimming under asymmetric power are too high for comfort and will therefore be reduced. However since only very small rudder angles and hence small footloads are needed in the course of normal manœuvres, the general impression of the handling qualities is one of comfortable and positive control. Several instrument approaches under radar control have been made in conditions of low cloud and the easy handling qualities quickly inspire confidence and make accurate flying almost automatic.

"At a weight of about 28,000 lb, power-off stalls have been performed with undercarriage up and flaps set to 'up,' 'take-off' and 'fully-down.' Stalling speeds under these conditions were 78, 65 and 59 kt respectively. There is practically no pre-stall warning in any of these conditions but the stall itself consists in each case of a gentle nose drop associated with a slight tendency to drop the starboard wing which can be countered by application of aileron. The elevator force to stall the aeroplane is moderately heavy and, since there are no self-stalling tendencies, inadvertent stalls are unlikely to occur. Some further development will be necessary to provide warning of the approach to stall.

"The landing circuit can be made quite comfortably at 95-100 kt and the undercarriage can be lowered and flaps set to take-off position at this speed. The final approach can be made without difficulty at 80-85 kt when full landing flap can be lowered. There is a noticeable nose-down change of attitude as the flaps go fully down. This gives a very fine unobstructed view of the runway. There is no tendency to sink rapidly during round out and a reasonable float occurs before touch-down at about 68-70 kt. Almost full up elevator movement is required at touch-down and it is felt that to have a little in hand would provide a rather more pleasant impression for landing. This is being provided by altering the setting of the tailplane. Brakes, which are fitted with anti-skid devices, are smooth and powerful in operation and have enabled landing runs of 400-500 yd to be achieved regularly without difficulty.

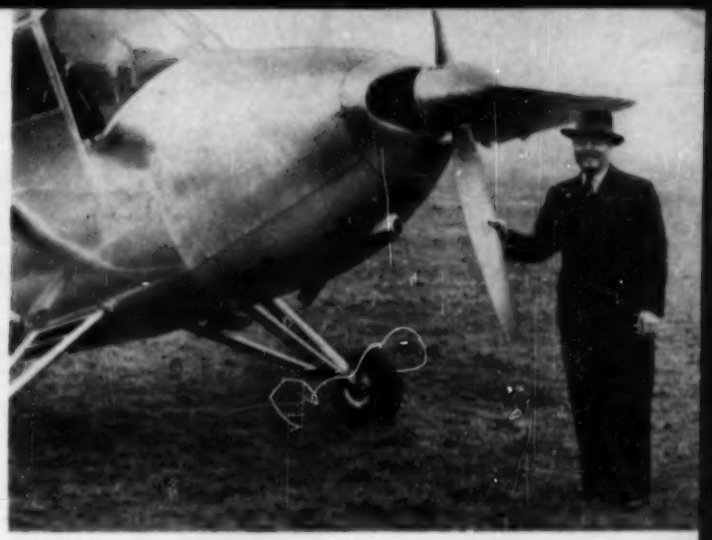
"Except for very minor faults the Alvis Leonides Major engines have so far been trouble-free. Response to the throttles is excellent with no flat spots. Throttle and pitch-lever alignment is extremely good throughout the whole range of movement. This has made the control of the four engines together much easier than is often the case on prototype aircraft. Synchronization is easy to obtain and subsequently is well maintained. Cooling of oil and cylinders can be controlled satisfactorily without difficulty by means of electrically-actuated shutters and cooling gills."

Summing up, S/L. Hazelden says that the Herald is "very easy and pleasant to fly and has adequate control to cope with any emergency, but that ease of control in the event of engine failure will be greatly improved by reduction of rudder footloads. The stall," he adds, "is gentle and, although there is no warning, it causes no alarm; there is no feeling that it might occur inadvertently even when flying at speeds only 5 kt above the stall."

"At weights up to approximately 29,000 lb, only a moderate pull is required to unstick at speeds of 60-80 kt . . ."

THE EDGAR PERCIVAL P.9

Famous Name Returns to the Scene With a New Agricultural All-rounder



The P.9 and its designer, Mr. Edgar Percival, pictured at Stapleford Tawney Aerodrome, where the machine was completed. "Flight" photographs

THE story of the development of the P.9, Edgar Percival's new agricultural aircraft (the completion of which was reported in *Flight* a fortnight ago) began in 1951, when this designer began considering the type of aircraft which might be most suitable for aerial topdressing operations in New Zealand. Mr. Percival, whose successful pre-war designs include the still-familiar and still-successful Mew Gull (this year's King's Cup winner), reached no firm conclusions until 1953, when he decided on a basic configuration and determined to study the New Zealand operating conditions at first-hand.

Before leaving for New Zealand and Australia in November 1953, Mr. Percival made the initial design calculations, weight and balance calculations, a three-view g.a., and a check of the c.g. positions to make sure he could achieve what he had set out to do with the particular aircraft configuration selected. He next spent two months in New Zealand, visiting owners, operators, ground crews and repair organizations; discussing their aircraft requirements; flying on a number of agricultural operations; and obtaining much relevant and valuable information. This was followed by a two-month visit to Australia for the same purpose, and subsequent visits to Fiji, Indonesia, the Malay States and India to examine the work being done in those countries.

The work being performed in New Zealand convinced the designer that there was even wider scope for aircraft in agriculture than topdressing alone—provided a sufficiently versatile machine were available, and particularly if it were economical in use. The P.9 design as originally set out before Mr. Percival's journey abroad is what has now been built, with very few alterations, valuable confirmation of his design views having been obtained from the operating countries. Shortly after returning to England in April 1954, Mr. Percival gathered a small D.O. staff together, and detail work was started at the end of May.

Edgar Percival Aircraft, Ltd., was formed in November 1954, to produce in quantity the P.9 agricultural aircraft. Initially the company's design office and factory were located in London; the move to Stapleford Tawney Aerodrome, near Abridge, Essex, was made in May of this year, when the fuselage tubular structure was almost complete. Since then progress has been steady, in spite of a number of setbacks caused by delivery delays. The completed aircraft was rolled out of its hangar on December 9th for engine running, and the first flight was to have taken place on December 20th.

Design Philosophy.—Although the P.9 has been designed primarily as an aerial fertilizing and crop-spraying aircraft, Edgar Percival aimed to cover not only the widest field of use for agriculture but also to make the machine a practical general-purpose vehicle for operations in undeveloped parts of the world. He set out to produce as useful a piece of equipment for bush and outback flying as possible. This versatility, however, had to be achieved without losing the good features of the basic design by any compromise.

For New Zealand, the main types of operations were: (1) aerial fertilizing; (2) anti-pest spraying; (3) supply-dropping to deer shooters (who are permanently employed in the mountain districts to destroy the large herds of wild deer); (4) the dropping of fence-posts and fencing material in the mountain country; and (5) transport of wool bales from remote mountain areas.

In addition to meeting the important requirements of carrying as good a useful load as possible on a given size of engine and having a good performance from small landing strips, the cardinal points of agricultural-aircraft design must include the safety of the pilot. The topdressing work as performed in New Zealand can be considered more hazardous than other forms of regular flying, and there has been much argument in the past concerning the best position for the pilot. In many aircraft at present used for fertilizing, the pilot is located between and on a level with the engine and the load. As a result, he is the "ham in the sandwich" in the event of a crash following engine failure during take-off or climb-away, especially in mountainous country. In the P.9 the pilot sits on a level which is above both the load and the engine.

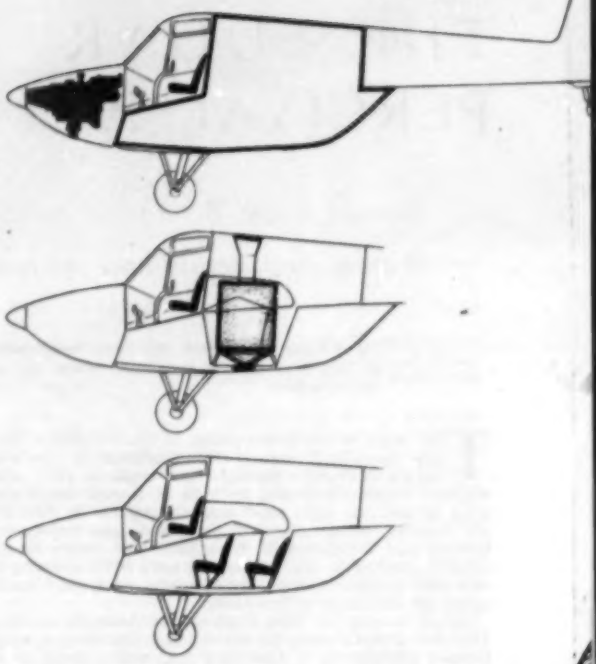
From the combination of the aircraft configuration and the pilot's position, a voluminous cargo space, or cabin space, results. The total cubic capacity of the cargo space and the pilot's compartment is 235 cu ft, total floor area being 50 sq ft. This cargo space, coupled with the low loading platform of the cabin floor, Mr. Percival points out, makes the P.9 a true "flying jeep." It can be used for transporting sheep or other small animals, standard bales of wool and other goods. The cabin can be loaded through the large side or through the clamshell doors at the rear; standard 45-gal drums of petrol or oil can easily be rolled in and carried. As an ambulance aircraft the machine can accommodate two stretchers, one sitting-up patient and an attendant in addition to the pilot, while as a passenger aircraft the P.9 is a six-seater with luggage.

An important factor when moving from one site to another on topdressing operations is that, in the P.9, a ground crew of three persons can be carried in addition to the pilot and the hopper.

The relative importance of durability and repairability is a basic

The capacious freight cabin and the overall configuration of the aircraft are apparent in this side view of the prototype P.9.

For ease of accessibility, cowling panels of the flat-six Lycoming are fitted with quick-release fasteners. The engine installation is well shown here. (Below) Maximum-flap position is at 50 deg, with the ailerons drooping 15 deg. Principle of operating linkage is shown on page 972.



Three sketches (right) showing positions of engine, pilot and large freight space, possible top-dressing hopper installation; and possible passenger layout with four seats in the main cabin.

EDGAR PERCIVAL P.9 . . .

consideration in the design of an aircraft for agricultural work. In the early days of topdressing in New Zealand a high accident rate led operators to feel that the emphasis should be on repairability. With the more recent reduction in the accident rate (because of improved operating technique and larger landing-strip areas), however, it can be argued that repairability, while remaining an important factor, should not be regarded as the governing one.

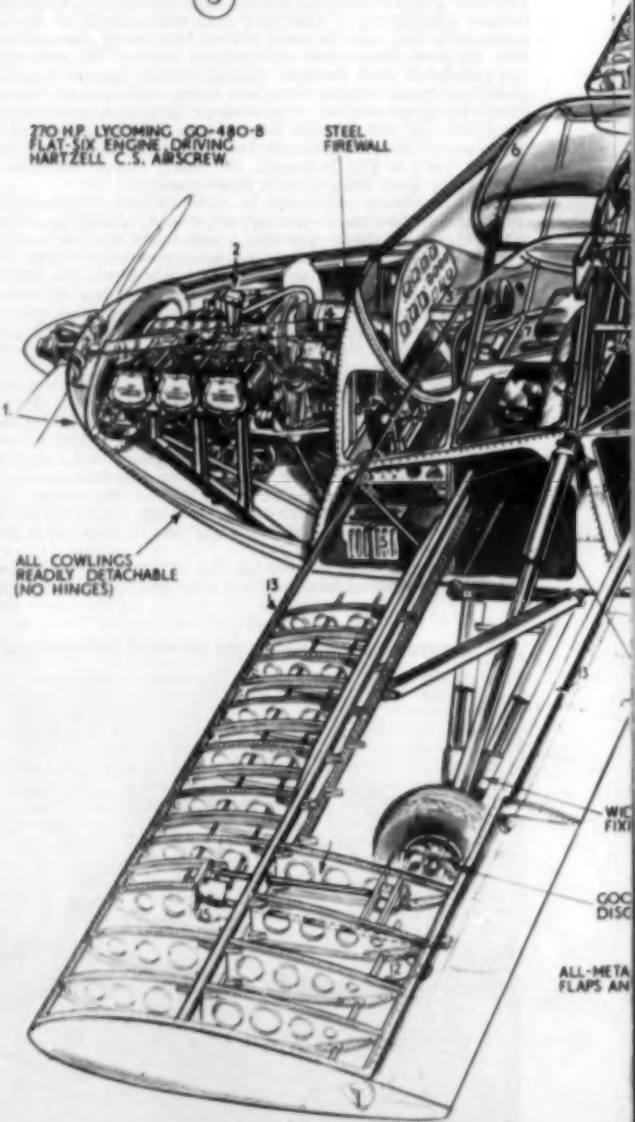
In discussing the type of structure best suited to New Zealand operations, Edgar Percival had to bear well in mind simplicity, in order to achieve a reasonable price; robustness, in order to stand up to the arduous work; and the prime factor of reasonable weight, so that a good economic load could be carried on moderate engine power.

"Because I was designing an aircraft that had a more universal application than for fertilizing and spraying alone," he told *Flight*, "I decided a metal stressed-skin wing was called for to meet the durability case. After due consideration I decided that without doubt the high-wing layout was most suitable for agricultural and rough-country work; and because of the high-wing layout we were able to make use of light-alloy wing covering, since the fertilizer or spray chemicals were unlikely to come into contact with the wing.

"The fuselage has been made of steel tubing because this material appears to be the most suitable to combat the corrosive effect of some of the fertilizers and sprays used in agricultural work. With light-alloy skin covered structures the corrosive effect of the fertilizers used is most marked at the lapped joints and under the rivets."

Fuselage.—The fuselage framework is of welded steel tubing, its geometry illustrated in the diagram on page 972. The tube material is T.45, the size of tubing varying from half-inch 22-gauge to 1¼in 14-gauge. At the welded joints, gussets are incorporated: finger-plates will be employed on production machines. From the tail to the freight cabin window, and forward above this window line to the rear of the pilot's door, the fuselage is fabric covered, wooden stringers being employed on top and side surfaces for shaping. Non-stressed skin panels of 26 gauge, L.72 light-alloy are used for the remaining front and lower fuselage.

Main wing-spar and undercarriage loads are taken by the heavy tube frame immediately behind the pilots' seats which carries, in addition to the main wing and undercarriage attachments, the combined wing-strut and rear lower undercarriage attachment fittings. The main wing attachment is by means of light fork fittings at the main-spar roots, picking-up on a fuselage cross-tube, the rear attachment being to the tubular trailing-edge member of the wing. The lower undercarriage attachments are machined


270 H.P. LYCOMING GO-480-B FLAT-SIX ENGINE DRIVING HARTZELL C.S. AIRSCREW
STEEL FIREWALL
ALL COWLINGS READILY DETACHABLE (NO HINGES)
ALL-META
FLAPS AN

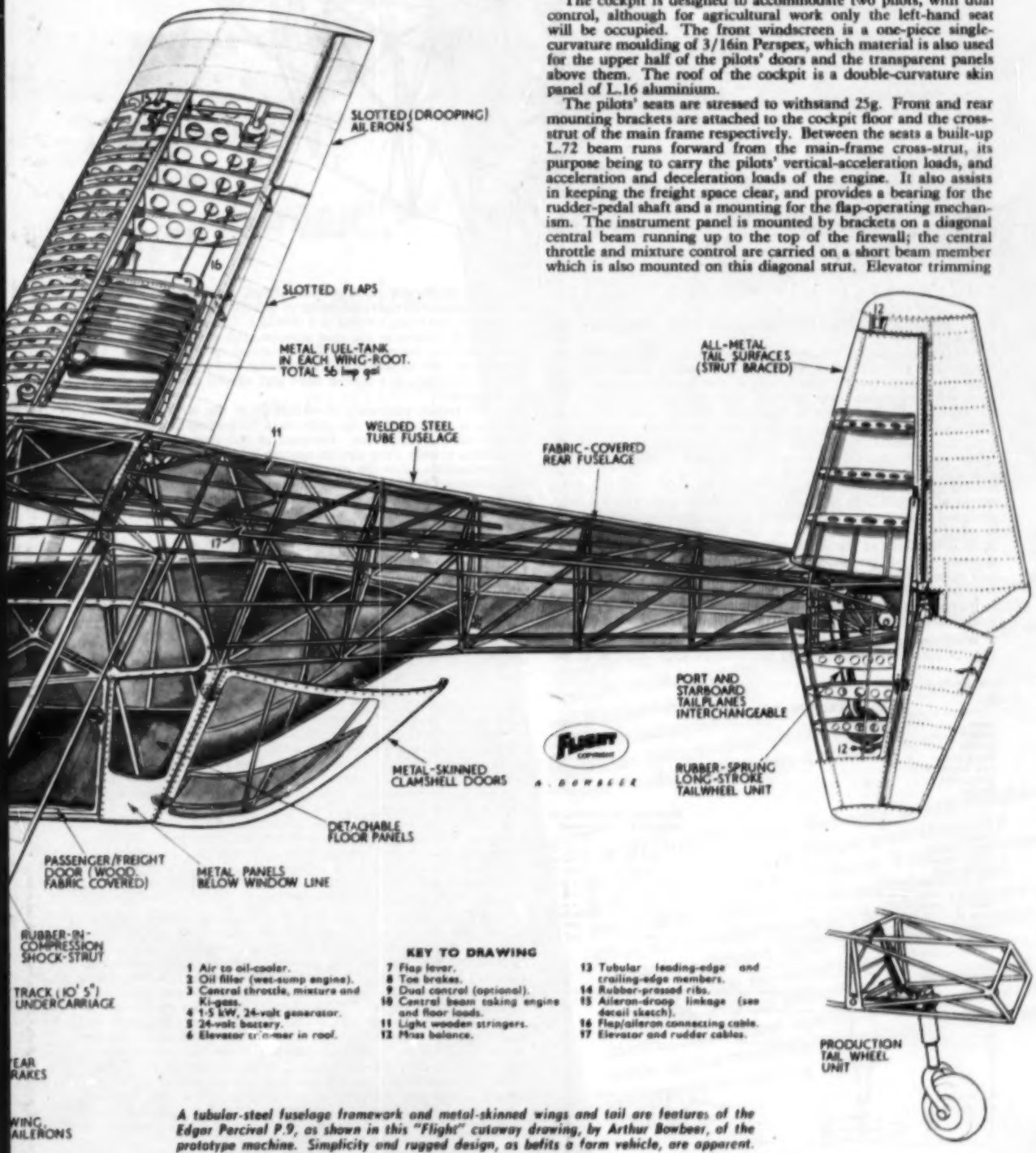
Dural lugs at each end of the base tube, the rear fitting acting also as the fuselage anchorage for the fork-ended wing-strut.

The power unit is a Lycoming GO-480-B1B horizontally opposed six-cylinder wet-sump engine of 270 h.p., driving a Hartzell HC-82X20-1B constant-speed airscrew of 7ft 6in diameter. The method of engine mounting is conventional, the engine itself being carried on four rubber-in-shear Lord blocks, and the engine bearers carrying the air-intake nose-ring and the oil radiator at their forward extremities. The four engine-cowling panels do not hinge, but are fitted with quick-release fasteners. Aft of the engine is a stainless-steel firewall, the lower section of which forms the foremost bulkhead of the freight cabin. A 24-volt battery is located aft of the firewall, beneath the pilot's cockpit, on the port side.

The undercarriage, of Percival design, employs rubber-in-compression main struts and has a track of 10ft 5in. The lower vee struts are of T.45 steel tube. Goodyear wheels and hydraulic disc brakes are fitted. The undercarriage has been designed for a vertical velocity of 9ft/sec and, because of its long travel, is claimed to have better energy-absorption characteristics than many deck-landing undercarriages designed to 11ft/sec.

The cockpit is designed to accommodate two pilots, with dual control, although for agricultural work only the left-hand seat will be occupied. The front windscreen is a one-piece single-curvature moulding of 3/16in Perspex, which material is also used for the upper half of the pilots' doors and the transparent panels above them. The roof of the cockpit is a double-curvature skin panel of L.16 aluminium.

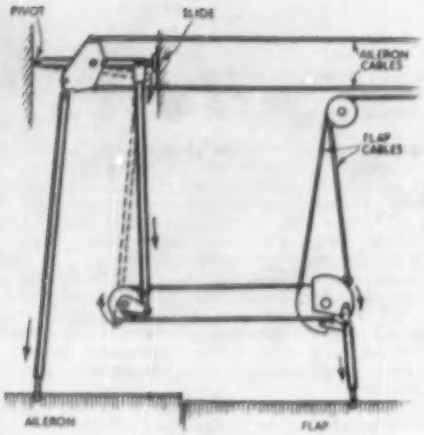
The pilots' seats are stressed to withstand 25g. Front and rear mounting brackets are attached to the cockpit floor and the cross-strut of the main frame respectively. Between the seats a built-up L.72 beam runs forward from the main-frame cross-strut, its purpose being to carry the pilots' vertical-acceleration loads, and acceleration and deceleration loads of the engine. It also assists in keeping the freight space clear, and provides a bearing for the rudder-pedal shaft and a mounting for the flap-operating mechanism. The instrument panel is mounted by brackets on a diagonal central beam running up to the top of the firewall; the central throttle and mixture control are carried on a short beam member which is also mounted on this diagonal strut. Elevator trimming



KEY TO DRAWING

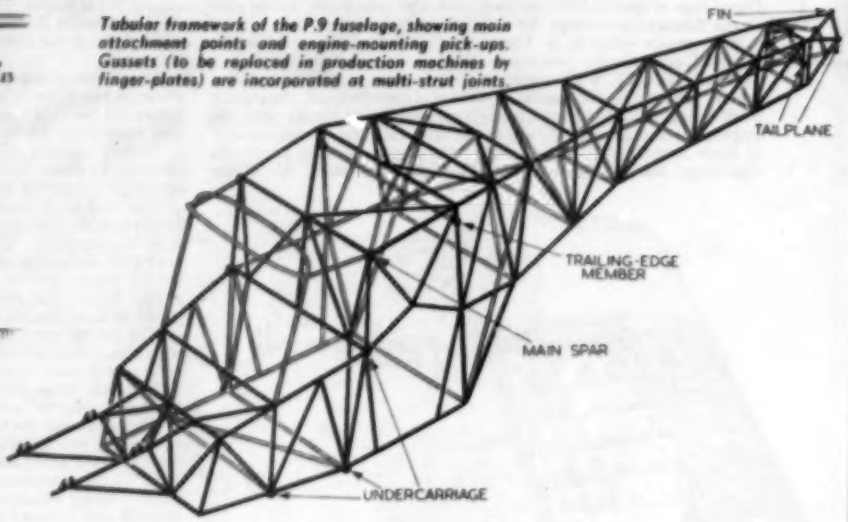
1 Air to oil-cooler.
2 Oil filler (wet-sump engine).
3 Central throttle, mixture and Ki-gass.
4 1·5 kW, 24-volt generator.
5 24-volt battery.
6 Elevator trimmer in roof.
7 Flap lever.
8 Toe brakes.
9 Dual control (optional).
10 Central beam taking engine and floor loads.
11 Light wooden stringers.
12 Mass balance.
13 Tubular leading-edge and trailing-edge members.
14 Rubber-pressed ribs.
15 Aileron-droop linkage (see detail sketch).
16 Flap/aileron connecting cable.
17 Elevator and rudder cables.

A tubular-steel fuselage framework and metal-skinned wings and tail are features of the Edgar Percival P.9, as shown in this "Flight" cutaway drawing, by Arthur Bowbeer, of the prototype machine. Simplicity and rugged design, as befits a farm vehicle, are apparent.



Operating principle of the aileron-droop mechanism. As the flaps are lowered to 30 deg, the ailerons are depressed 15 deg by means of the linkage shown. Continuation of flap lowering to 50 deg causes the ailerons to be raised slightly.

Tubular framework of the P.9 fuselage, showing main attachment points and engine-mounting pick-ups. Gussets (to be replaced in production machines by finger-plates) are incorporated at multi-strut joints.



EDGAR PERCIVAL P.9 . . .

is by means of an irreversible worm-gear wheel mounted in the cockpit roof.

The large-capacity freight cabin has lightweight floor panels comprising a balsa-wood core and L.72 sheet skins. On the prototype machine the side door of the freight compartment is of simple wooden construction, fabric covered; in production machines, L.72 light-alloy construction will be used. The rear clamshell doors each consist of a one-piece metal skin over a steel-tube framework, and can be opened only from the outside. The side skin panels are riveted to formers which in turn are attached to the fuselage tubing.

The hopper to contain the fertilizing chemical, which will be mounted in the P.9 as shown in the sketch on page 970, has been designed and is being manufactured at Stapleford Tawney, but was not fitted in the machine for its first flight on December 20th. Rate of delivery of fertilizer will be governed by adjusting the size of a slot at the bottom of the hopper; an emergency release will open the full 20in × 15in aperture to dump the whole 1,550 lb fertilizer load in only five seconds.

Perspex is used for the freight-cabin windows, simple light-alloy frame members providing the boundary contour.

Wing.—The wing section of the P.9 is developed from the NACA laminar-flow series, and has a constant t/c ratio of 12 per cent. The single spar, at 32 per cent chord, is simple and ingenious, top and bottom flanges consisting of straightforward 90-deg angle extrusions and being riveted to a web of L.72 sheet. To fit in with the aerofoil section at the spar position, the whole spar has been tilted, the top boom being slightly ahead of the bottom. The pressed ribs are all identical, leading-edge and trailing-edge members are tubular, and slotted flaps and slotted drooping ailerons are employed.

In the region extending to each side of the strut attachment, the spar is reinforced by the addition of backed-up top and bottom flanges on the front face. Forward of the spar (except for the three bays at each wing-tip) rib spacing is halved with the addition of intermediate nose-ribs which, along the length of the tank bay, are continued back to a false rear-spar member which carries the vertical loads of the tank. The metal (L.59) fuel-tanks, which extend outboard to rib 7 on each wing, each have a capacity of 23 gal. Ribs are attached to the spar by means of riveted folded brackets, top and bottom.

The wing leading-edge member is ¼in diameter tube of 22-gauge L.62, and the trailing-edge member a 1in tube, 17-gauge, of the same material. The aerofoil section of the slotted flap is developed from the NACA 230 series, and the mechanically operated flaps can be lowered to 50 deg. The flap-operating mechanism is utilized to droop the ailerons, which reach their maximum droop of 15 deg when the flaps are at the 30 deg position (see diagram). Ailerons and flaps are of identical and simple construction, utilizing flanged-sheet spars and light ribs. Both ailerons and flaps have three hinges port and starboard, the centre hinges of the ailerons carrying mass-balances. Wing skinning is of L.72 alloy, 22-gauge inboard and 24-gauge outboard.

Pop-riveting is used throughout on the P.9, with plastic filler fairing the internal holes. On the wing, fuel filler caps are provided in the upper surface approximately halfway along each tank, covered by an access panel; other access panels are provided adjacent to flap-actuating linkage, aileron-droop mechanism, and various pulley groups.

The two external wing-struts, of streamlined section, carry fork fittings at each end. The wing fitting is machined from a T-section extrusion; the fuselage fitting, as mentioned, also carries that for the rear undercarriage-leg attachment. Main wing/fuselage attachments are the fork fittings already described, at the main spar and tubular trailing-edge members.

Tail Unit.—The fuselage longerons converge gently as far aft as the penultimate frame, which is double and is joined to the diamond-shaped sternpost frame by short lengths of tubing, with appropriate triangulation and gussets. Both tailplane and fin are attached directly to lugs on the tubing of the penultimate frame and at the upper and side extremities of the diamond end-frame.

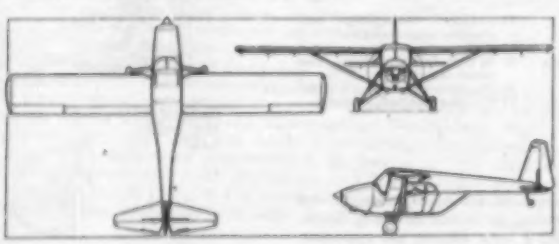
The construction of the tail surfaces is similar to that of the wing and is extremely light. The rudder is horn-balanced and mass-balanced, while the elevators carry lead static-balance weights on tubes projecting forward from the undersurfaces. Elevator trim-tabs also are fitted. The attachment of the tail unit to the fuselage and of the tail bracing strut to fin and tailplane is by horizontal pins through tongue fittings. Port and starboard horizontal tail-surfaces are interchangeable, the undersurface of each tailplane being slotted to take the strut if moved to the

(Concluded at foot of page 982)

EDGAR PERCIVAL P.9.—LEADING DATA

Span	43ft 6in
Length	30ft 0in
Height	8ft 9in
Wing area	237.6 sq ft
Fuel capacity	46 Imp. gal
Endurance	4.75 hr
Range	575 st. miles

	Normal category	Agricultural overload
Power	270 h.p.	270 h.p.
Gross weight	3,415 lb	3,675 lb
Empty weight	1,880 lb	1,880 lb
Useful load	1,565 lb	1,835 lb
Top speed (sea level)	138 m.p.h.	137 m.p.h.
Cruising speed (sea level)	123 m.p.h.	122 m.p.h.
Landing speed (light)	57 m.p.h.	57 m.p.h.
Rate of climb (sea level)	1,090ft/min	960ft/min
Take-off run (grass field, 5 m.p.h. headwind)	127 yd	185 yd
Take-off run (grass field, zero headwind)	145 yd	205 yd



Communications

Rescue

Minesweeping

Reconnaissance

Supply dropping

Trooping

Casualty evacuation

WESTLAND

WIDGEON

THE Westland Widgeon is the latest general-purpose, medium-size Helicopter to be built in Britain. It is a development of the famous and versatile Dragonfly and incorporates many of the well-tried and highly successful engineering features which have been responsible for the outstanding success of Westland Helicopters.
With accommodation for four passengers and pilot — or two stretcher cases, medical attendant and pilot — it offers great possibilities for many civil and military roles.

WHIRLWIND

THE Westland Whirlwind Helicopter is now available with the Alvis Leonides Major Engine as an alternative to the standard Pratt and Whitney Wasp. This powerful British engine gives the Whirlwind enhanced load lifting and hovering ability and increases the height attainable in forward flight. These additional attributes of a Helicopter that has already been proved during world-wide civil and military service are particular considerations where operation is required in countries where high atmospheric temperatures, humidity and altitude are determining factors.

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The Alvis Leonides Major gives the Westland Whirlwind enhanced load-lifting and hovering ability and increases the height attainable in forward flight.

ALVIS LEONIDES MAJOR

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Power for British Helicopters

The new Westland Widgeon,
like the Dragonfly,
is powered by
the Alvis Leonides engine.

ALVIS LEONIDES MAJOR

ALVIS LIMITED ALVIS COVENTRY ENGLAND

40,000 ft. apart

Squadron Leader J. S. Fifield, D.F.C., A.F.C., by a recent successful ejection at ground level, demonstrated the capability of the latest Martin-Baker fully automatic ejection seat to bring about safe escapes near the ground at low forward ejection speeds. A further important requirement of an ejection seat lies in its high altitude performance. Martin-Baker fully automatic ejection seats are designed to bring the seat occupant safely down from the ejected altitude, stabilised and under control, to a selected altitude at which parachute deployment and separation of the occupant from the seat is automatically performed.

The altitude of the live ejection demonstrated at Chalgrove on October 25th was over 40,000 feet, and the altitude of separation 10,000 feet.

Martin-Baker

AIRCRAFT COMPANY LIMITED

TRYING OUT the D.H.C. OTTER

By C. M. LAMBERT

THE Canadians, more than anyone else, know what is required of a bush-flying aircraft. It is in their country that a large proportion of this kind of flying is done; and the Canadian constructors have the market for this type of aircraft right on their doorstep.

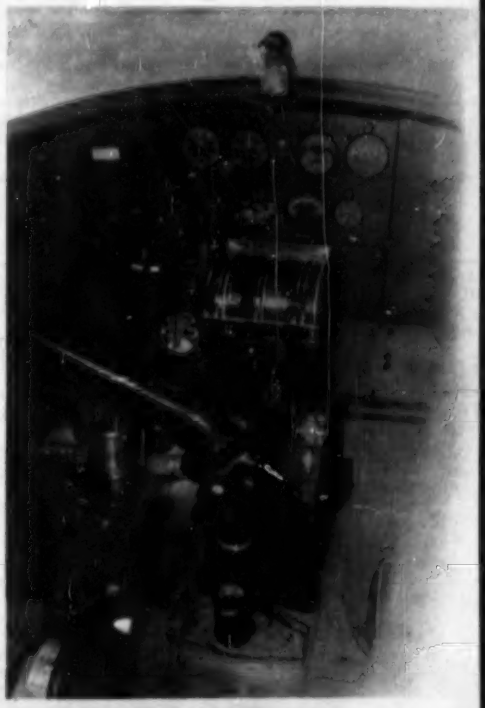
With particular interest, therefore, I took the opportunity of flying the D.H.C. Otter demonstrator (which is kept at Hatfield) in order to see how the Canadians cater for their special operating conditions. Many of the main features may at first seem out of the ordinary; but on close acquaintance one realizes what an excellent job the de Havilland Aircraft of Canada, Ltd., has made of a truly utilitarian aircraft.

Using basically the same layout as for the widely successful Beaver, the makers adopted a high-lift narrow-chord wing arrangement and fitted double-slotted flaps and double-slotted drooping ailerons. The powerplant chosen was a single P. and W. R-1340 geared engine of 600 h.p. with a Hamilton Standard three-blade constant-speed airscrew. The unrestricted cabin space of 16ft by 5ft by 5ft has a single door on the right-hand side, aft, and a large double loading-door 46.5in by 45in to port. The crew of two have a separate cabin forward, with individual access doors to right and left, and a series of steps and hand-holds spaced down the undercarriage. This latter is made up of simple triangulated struts with large-diameter tyres and disc brakes, the whole assembly being easily replaceable with either floats or wheel-ski combinations. Nine passenger seats in the cabin can be folded compactly against the walls to permit the use of the full cargo space. All fuel is carried in three tanks under the main cabin floor, with a total capacity of 178 Imp. gal, giving a maximum endurance at cruising power of 7.1 hr. An ample series of cold-air ventilation louvres can be used in warm weather, and a powerful combustion heater provides copious heat for cabin, cockpit and windscreen de-misting in cold weather. There is room for a wide selection of radio and navigation equipment, and everything is designed for simple operation, maximum reliability and the flying characteristics most suited to bush flying.

It was mainly this latter aspect which interested me during my visit to Hatfield. The qualities and economics of the machine are widely known and proved by the large number of Otters already sold for use all over the world. Flying the Otter is very pleasant indeed, and its landing and take-off characteristics are remarkable. A little preliminary briefing is, however, required to prevent a slight surprise for the uninitiated. During my short visit I found that what might be interpreted as a bogy turned out to be an amusing and valuable performance characteristic.

With a high-lift wing of this type and such extensive "slottery" and drooping ailerons, a pronounced change of attitude and trim cannot very well be avoided during slow flying. Yet, by providing very powerful horizontal tail controls, the designers have completely avoided any of the discomfort which might otherwise have arisen. The tailplane has, in fact, been arranged as a completely movable unit in order to give full control in the fully drooped condition; but, even more important, it also allows the aircraft to be fully loaded over a fabulously wide range of c.gs. without adverse effect on its handling characteristics. It is therefore possible to open the Otter's doors and hurl in variegated freight with the gayest abandon. The pilot thereafter can glance back into the cabin and assess very roughly his c.g. position, adjust the tailplane accordingly and know that he will not run into any trouble.

The tail is arranged as follows: the incidence of the fixed part can be adjusted over a wide range by winding a very low-geared trim wheel mounted on the right of the first pilot's seat. The arc of movement of the elevator is then displaced with the tailplane so that the maximum deflection angle of elevator relative to tailplane is always the same regardless of the tailplane incidence setting. It is therefore recommended that stick forces should be trimmed out as they occur, at all times. The tailplane incidence indicator is located next to the trim wheel, and the position scale is marked by numbers backward and forward from the neutral position and with such indications as "c.g. forward" and "c.g. aft."



The Otter's cockpit (right) is simple, as becomes a bush-flying type. Everything except radio and the less-used electrics are grouped immediately round the pilot's seat. There is a remarkable similarity between the aircraft's attitude just after take-off (below, left) and shortly before touch-down (below, right). There is, however, a distinct difference in the two tailplane and elevator angles. In each case, the speed is about 55 m.p.h., and ground run very short indeed.

The Otter, in cruising flight, is very pleasant to handle and gets along at a comfortable 130 m.p.h. plus.

Such features as double slotted flaps and ailerons, large doors and hefty undercarriage mark the Otter as a bush flyer.

TRYING OUT THE D.H.C. OTTER . . .

I climbed into the Otter at Hatfield with Derek Taylor, D.H. test pilot, after flying as passenger in the starboard seat. Although the control column is centrally mounted and can, at any time, be swung over to port or starboard for either pilot, there are no rudder pedals and no seat adjustment to starboard, and flap hand-pump lever, selector and trim wheel are all positioned for the first pilot. Throttle, pitch and mixture levers (with individual friction nuts) and engine instruments are mounted centrally; primer, carburettor-heat control, fresh air control, fuel and oil emergency shut-off, are below them. A small knurled wheel at the base of the control column applies aileron bias by offsetting the neutral position of a small bungee. An ashtray is mounted next to it. Electrical, fuel, fire-extinguishing and engine-starting controls are each grouped on separate panels conveniently distributed around the main instruments. Seat height and rudder pedals are adjustable, and controls come easily to hand.

A three-position switch takes care of tailwheel control. With the switch central, the tailwheel is fully free. If it is pressed to the right, the wheel is locked fore and aft, and if pressed to the left, an electric motor turns the tailwheel to a position equivalent to that of the rudder pedals. Thus, take-off and taxying in strong cross-winds benefit from a wide variety of means of control which, when used in combination, make light work of an often difficult process.

Visibility over the nose is good, both on the ground and in the air, because the engine cowling is very short. The closeness of the engine to the cockpit, however, does result in a high cabin noise level, though one fancies a bush flyer would not be excessively concerned thereby.

In the air, with everything up and in, the Otter is very pleasant to fly. All controls are light and positive, and the stability characteristics excellent. The aircraft can really be left to drive itself across the sky at a comfortable 130 m.p.h. For take-off, we carried out the normal sequence of checks, and set the tailplane for the estimated c.g. which, in this instance (three people, about two-thirds fuel load and some ballast aft) was just forward of neutral. We pumped down what seemed to be an inordinate amount of flap and aileron droop. There are three indicated positions, "climb," "take-off" and "landing." I locked the tailwheel central, and applied power gently. At low altitudes, it is possible to exceed the permissible boost limit of 36.5in, and care must be taken in this respect; but the feature is deliberate, since it allows the attainment of maximum permissible boost on airfields considerably above sea level.

When I applied power, the Otter rolled forward with a slight tendency to swing to port which could be easily held on the rudder. Very soon, the tail rose firmly, and almost immediately the aircraft could be flown off to climb away steeply at 700 ft/min with, it appeared, the nose still pointing at the ground. While the tendency is normally to pull the nose well up above the horizon, in the Otter it has to be held firmly down. This is the first evidence of a pronounced nose-down attitude when flaps and ailerons are drooped. The climb away is otherwise normal; and, because of the attitude, the visibility is excellent. Stick forces are light. I pumped the flaps up by stages, re-trimmed each time and settled comfortably into the cruise. The Otter is very smooth, both when being thrown about and when allowed to fly hands off. I was shown the stalls by Derek Taylor, and saw that they were completely vicelees. In fact, the main indication of the stall is the lighting up of the stall-warning indicator and a gentle mushing descent at about 500 ft/min. Neither wing nor nose appeared to drop.

On the downwind leg flap can be lowered as soon as the speed drops below 100 m.p.h. I had been warned of the attitude change which would result and, though the out-of-trim stick forces remain quite reasonable, it is advisable to trim them out. As I pumped, the nose went lower on the horizon, and still the stick had to be pushed forward to maintain speed. By the time we reached finals, I was looking at the touch-down point through the top of the windscreen, with the result that the whole of the approach area was easily visible. Control was good; in fact, everything was normal except that the after end of the cabin floor seemed to be some way above the level of the pilot's head. In this attitude we began the round-out which, as can be imagined, was quite a considerable manœuvre. It was, however, accomplished very easily, and the judgment of height and attitude became perfectly normal as soon as the Otter reached an even keel. As the touch-down speed was reached, I held the control wheel right back against my stomach, and the Otter settled on to the ground with a hardly perceptible bump. The undercarriage shock absorption is, in fact, superb, and the ground run, with or without brake, seems to be negligible.

The whole landing process might sound somewhat fraught, but it is amusing rather than difficult. The considerable change of attitude can be accomplished during the float without any sign of stalling or mushing and the aircraft appears to be completely happy. The landing speed is in any case so low that there is ample time in which to ensure a three-point touch-down. One is tempted to do a "wheeler," but nothing is to be gained by it, and it could only lead to a time-wasting bounce. After one take-off and landing, I wanted nothing more than a quiet hour of circuits and bumps in which to perfect the technique and to produce some of the ultra-short landings which those who know their Otter invariably make.

D.H.C. Otter Loading Data.—Span, 58ft; length, 41ft 10in; height, 13ft; cabin size, 16ft by 5ft by 5ft, 345 cu ft; disposable load, 3,242 lb; empty weight, 4,358 lb; gross weight, 7,600 lb; maximum speed at 5,000ft, 160 m.p.h.; cruising speed at 5,000ft, 139 m.p.h.; service ceiling, 19,000ft; stalling speed, 45 m.p.h.; take-off run, full load, no wind, 600ft; take-off run, full load, 20 m.p.h. wind, 360ft; landing run, 480ft; fuel capacity, 178 Imp. gal; maximum range at 5,000ft (no allowances), 1,063 miles; maximum endurance at 5,000ft, 10.3 hr; payload for 200 miles still-air range, 2,550 lb; ditto for 500 miles, 2,310 lb.

Classics of Aviation Literature

A Collector's Recollections

By PETER W. BROOKS

BOOKS about flying have been a hobby of mine almost since I could read. Indeed, some of the books on my shelves have been in the family longer than that. They were acquired by my father when he was flying during the First World War.

Twenty years of rummaging in second-hand bookshops, limited only by the time and money I could afford, has filled my home with half a dozen bookcases of assorted aeronautical publications. Of the 25 or so shelves which these cases contain, one is devoted to my favourite books—to works which I find I most enjoy and which contain in special measure thoughts, impressions and facts about flying which seem to be more true to life and lasting than those in the rest. These books, no doubt, are amongst those which will one day become the classics of the new element.

Glancing along this privileged shelf, I think many would give pride of place to two masterpieces about the First World War: *Sagittarius Rising*, by Cecil Lewis, and *War Birds: The Diary of an Unknown Aviator*, compiled by Elliott White Springs from the rough diary of an American fighter pilot, John Grider, who flew and died with the Royal Flying Corps on the Western Front. *Sagittarius Rising* stands by itself as a true record of what a pilot feels and thinks when he is in touch with his element in the intimate way which was possible with the light-aeroplane Service types of those days. Lewis's more recent novel, *Pathfinders*, about flying in the Second World War, reveals again his power of descriptive writing at a poetic level; but it lacks the rare quality of his first book. Only one other writer, in my opinion, approaches Lewis's artistry in descriptions of the First War period. David Grinnell-Milne, in *Wind in the Wires* gives, particularly, an account of learning to fly and some of his early solo flights which has a special appeal. *War Birds* is in a different class. It lacks the beautiful descriptive passages of Lewis and Grinnell-Milne, but gives, like nothing yet written, a wonderful impression of the lives and attitude to life—and death—of the operational pilots of the First War.

White Springs followed *War Birds* with a series of books (*Above the Bright Blue Sky, Nocturne Militaire*, etc) which continued the same theme and which sold in large numbers between the wars; but they never quite achieve the stature of the original diary.

Flying-boats in 1914-18

Another book about the 1914-18 war earns a place. Snowden Gamble (who was Press officer for Imperial Airways in the 1930s) wrote *Story of a North Sea Air Station*, about the war record of the flying-boat base at Great Yarmouth. This again is quite different in style from the books already mentioned. It records history in a precise and authentic manner which rings true in every line but which remains eminently readable. The illustrations by Leonard Bridgman are an essential part of this book and link it with another in which the same artist excels himself. Oliver Stewart's *The Clouds Remember* draws the character in word and picture of many of the famous aeroplanes of the 1910 to 1920 period. No flying enthusiast reading it can fail to acquire some appreciation of the fascination of handling those early flying machines, so many of them with famous names now firmly interwoven with the traditions of the Air Service.

Leaving the First War, the private flying and record-breaking era of the 1920s and 1930s provided material for several books which have earned their niche. John Leeming's *Airdays* stands out as a uniquely humorous account of club flying in its early days; and with that relaxed book I would link the intense writings of John Llewelyn Rhys, who was to lose his life flying in the Second War. His *The Flying Shadow*, *The World Owes Me a Living* and *England is My Village* all contain much which has merit, and a sense of the air which few writers have captured in words either before or since. F. H. White's *England Have My Bones* also contains passages about private flying which are often overlooked but which deserve to be remembered.

David Garnett's *Rabbit in the Air* is another enjoyable description of learning to fly on Moths and Bluebirds by a well-known writer. Garnett also wrote *The Grasshoppers Come*, an unusual account of a fictitious—but so true-to-life—record flight of the type undertaken in the great days of Mollison, Scott and Kingsford-Smith. We do not have to go to fiction, however, to recapture the atmosphere of those adventurous people who flew small aeroplanes vast distances across the world in spite of a complete lack of ground facilities and navigational aids. Some of the best aviation writing in the English language is by Anne Morrow Lindbergh, wife of the famous American pilot, and describes her experiences flying with her husband. Both *North to the Orient* and *Listen! The Wind* deal with long-distance flights by the Lindberghs in a Lockheed Altair floatplane. They contain passages which capture the atmosphere of flying and of sights of the Earth from the sky in a quite remarkable way. Mrs. Lindbergh also wrote a short novel *The Steep Ascent* which, although fiction, again reveals the same talent. Charles Lindbergh himself has recently published an account of his famous flight from New York to Paris in 1927. *Spirit of St. Louis* is actually the second book Lindbergh wrote about this flight but, unlike the first, it will undoubtedly qualify as a classic. Interspersed with his story of each stage of the great flight are glimpses—in the form of snatches of reminiscence—of his past career, and they give a colourful picture of the early days of civil flying in the United States.

Another famous pilot who has made his mark as a writer is Sir Gordon (Captain P. G.) Taylor, who started record flying as an associate of Kingsford-Smith. He has written five books *Pacific Flight*, *VH-UXX*, *Call to the Winds*, *Forgotten Island* and *Frigate Bird* which all qualify for my special shelf. They are all very much books by a pilot and they all breathe that sense of the air and of a pilot's viewpoint which can only come from long hours at the controls.

Francis Chichester's *Solo to Sydney*, *Seaplane Solo* and *Ride on the Wind* are also written by a man who flew light aeroplanes to distant parts of the world in the memorable 1920s and 1930s. *Seaplane Solo* describes a remarkable solo flight in a Moth floatplane across the Tasman in three stages, navigating entirely by "astro". It colourfully portrays that urge for personal triumph over the great open spaces and the uncharted elements which was the chief inspiration of those gallant men and women who, in small aircraft of barely a hundred horsepower, faced the unknowns of weather and distance on pioneering long distance flights.

Between the Wars

Four books by John Grierson, *Through Russia by Air*, *High Failure*, *Jet Flight* and *Air Whaler* bridge the period from between the wars to that of the past ten years of peace. The first two describe typical pioneering light aeroplane flights while the third is a classic about test flying during the war. *Air Whaler* is an account of flying experiences in an unusual field in more recent times: spotting whales in the Antarctic with a Walrus amphibian.

Service flying between 1918 and 1939 produced a number of notable books, of which Sir Roderick Hill's *The Bagdad Air Mail*, Frank Tredrey's *Pilot's Summer*, Robert Winston's *Dive Bomber* and Oloff de Wet's *Cardboard Crucifix* are particular favourites of mine.

We have not yet mentioned perhaps the greatest airman-writer of them all. The works of the Frenchman Antoine de St. Exupéry must have a place in any list of famous aeronautical books. Much has been said and written about "St. Ex." and I do not intend to pass judgment here on *Southern Mail*, *Night Flight*, *Wind, Sand and Stars*, and *Flight to Arras*. They all qualify, in their English editions, for inclusion in my list. If one can read French, the original texts in their author's native tongue are even more deserving.

Richard Hillary's *The Last Enemy* must stand as a prime representative of air literature about the last war. There have, of course, been many air books about the 1939-45 conflict but few, in my opinion, really make the grade as lasting examples of the writer's art. Some, like *Enemy Coast Ahead* by Guy Gibson, V.C., *Not Peace but a Sword* by R. P. M. Gibbs and *God is My Co-pilot* by Robert Scott have something of the direct narrative quality of James McCudden's *Five Years in the Royal Flying Corps* written 25 years earlier; but none, I think, really does justice to its theme. Paul Brickhill's *The Dam Busters* and *Reach for the Sky* have done something since the war to fill the gap at second-hand—but that, after all, is not the same thing. Perhaps another Frenchman, Pierre Clostermann, with his *The Big Show* and *Flames in the Sky*, has come nearer than any other to what we are looking for.

I have nearly reached the end of my special shelf, but on it are still two books that claim attention. Terence Horsley's *Soaring Flight* combines description of gliding in the 1930s with flying experiences in aeroplanes during the Second War to give a picture of the new element—a picture of a kind which few have had the experience and skill to put into words. With his work, I couple Harold Penrose's *I Flew with the Birds*.

WIDGEON AND WHIRLWIND

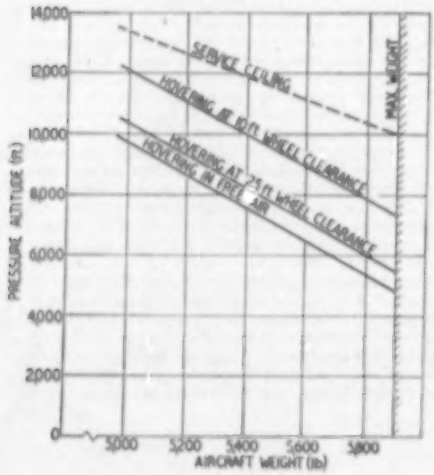
—with Power by Alvis: A Report on Two Current Westland Developments

DEMONSTRATED for the first time at this year's S.B.A.C. Show, the Westland Widgeon promises to provide a useful and economical extension of life to the well-tried S-51 Dragonfly design. The basic change made in the conversion of the Dragonfly to the Widgeon has provided an increased c.g. range which is reflected both in enhanced handling qualities and in an increase in all-round usefulness of the machine in civil and military applications. Another important development under way at Westland Aircraft, Ltd., at Yeovil, is the preparation for production of S-55 Whirlwind helicopters powered by Alvis Leonides Major engines. Following a recent visit to Yeovil we give here a description of the Widgeon and a progress report on the Leonides Major Whirlwind.

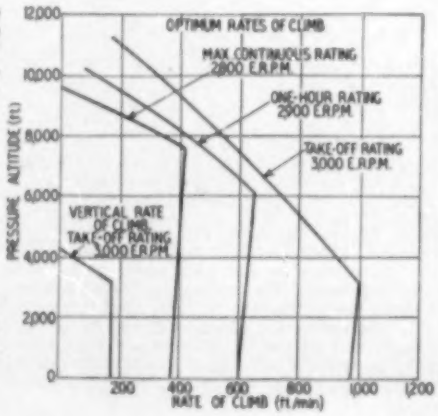
Widgeon.—The modifications incorporated on the prototype Widgeon G-ALIK, previously an S-51 Mk. 1A, are the new cabin section with revised seating and dual control; a revised flying-control system; and an increased operating c.g. range obtained by fitting the offset flapping-hinge rotor-hub of the Whirlwind.

Any enlargement or major alteration of the cabin alone of the Dragonfly would have been restricted in its usefulness due to the limited c.g. range of the original machine, and for this reason the use of the rotor head and upper gearbox section of the Whirlwind has provided the most significant of the modifications. The offset flapping-hinge system of the Whirlwind, compared with the Dragonfly's rotor-head with flapping hinges located on the centre-line, effectively raises the apex of the c.g. cone, consequently extending the permissible c.g. range of the Widgeon. Flight tests have covered a c.g. range from 5.2in aft to 7.7in forward of the rotor (at a weight of 5,900 lb), and this range is being further extended by tests now in progress. For a standard Dragonfly, the c.g. range was from 1.2in to 5.0in forward of the rotor at the same weight. The use of forward and aft ballast weights to accommodate extremes of loading conditions is thus not required in the Widgeon.

Since the second-stage epicyclic reduction gearing of the Whirlwind provides the same reduction ratio as that of the Dragonfly, it has been found a simple matter to bolt this section of gearing together with the rotor mast and rotor hub on to the existing



(Left) Hovering performance of the Widgeon, fitted with Alvis Leonides Type 521/1 engine (I.S.A. conditions, 3,000 e.r.p.m., 6½ lb boost).



(Right) Rates of climb for the Widgeon (Leonides 521/1), assuming I.S.A. conditions and all-up weight of 5,900 lb.

Cockpit layout of the Widgeon. Since this photograph was taken, a second set of controls has been fitted in the left-hand seat position.

Dragonfly lower main gearbox, the only modifications required being an amount of local machining of the lower end of the rotor shaft, reconnection of the oil supply lines and detail changes to the pylon steady strut attachments. The main rotor blades have been constructed from standard leading-edge extrusion and trailing-edge sections used for the Whirlwind. They are larger than those of the Dragonfly and smaller than those of the Whirlwind, providing a sweep of 49ft 2in diameter.

No other changes have been made to the normal Dragonfly transmission, the Leonides 521/1 powerplant installation remaining unaltered. The possible future use of the Leonides 523/1 engine, with higher max. continuous power, appears attractive, for it would give the Widgeon improved cruise and climb performance.

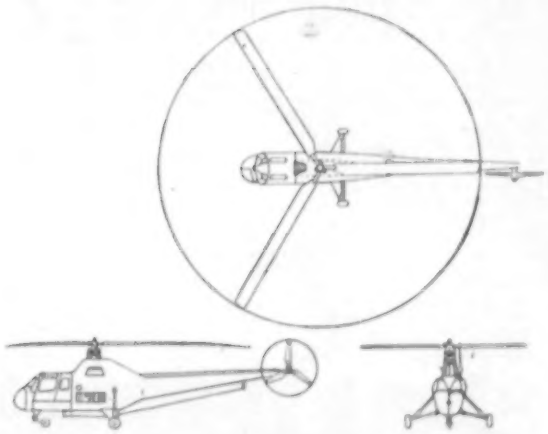
The cabin section of the S-51 has always been a separate airframe sub-assembly, consisting of the fuselage ahead of the fireproof bulkhead at the base of the rotor pylon structure. This bulkhead is an inverted egg-shaped section, the cabin of the Dragonfly providing seating for three abreast at the rear of the cabin and then narrowing to accommodate the centrally placed pilot in the nose. In revising the cabin to the form of the Widgeon, the rear-bulkhead fuselage cross-section has been retained and has been kept constant forward to the nose, thus providing space for the second pilot's seat. The front windscreens are flat and have been brought closer to the pilot's eye, and the pilot's view sideways and downward is improved with bulged side-windows.

Certainly apparent from an inspection of Dragonfly and Widgeon, and doubtless also apparent from flying the two machines, is the fact that the control system has been cleaned-up and improved. The central control-run tunnel is now below floor level and so does not take up space in the cabin proper. From the pilot's point of view there is now less friction in the flying-control system; push-pull rods and levers having largely been substituted for the previous cable controls.

Only in the tail-rotor controls are cables still used. The rudder pedals are connected *via* a tee-lever and rocker lever to a push-pull rod linkage to an underfloor quadrant, from which cables run *via* a pulley system to the tail-rotor cable drum. At the base of the control column, fore-and-aft and lateral control push-pull rods run from a torque shaft and tee-lever respectively to a mixing unit at the base of the rear cabin bulkhead. From rocker levers at the mixing unit vertical push-pull rods are carried up the bulkhead to larger rocker levers, which carry a final rod connection to the hydraulic servo-jacks and so to the rotor-hub. The collective-pitch lever torque-shaft has a push-pull rod linkage *via* a bell-crank lever to the mixing unit, from which the linkage is as described above.

The flying controls at the rotor-hub are the same hydraulic servo-jacks (with no feedback) as used hitherto on the Dragonfly and Whirlwind, and are powered from the same source on the tail-rotor transmission shaft. Manual reversion is provided. The control system is fully duplicated, the dual collective and cyclic pitch levers being accommodated on appropriate cross-shafts. The directional-control pedestals are manually adjustable, and from them the hanging-type rudder pedals are pivoted. Also fitted in the Widgeon is an improved form of instrument panel.

At present the dual control system is being flight-tested and



Two views of the prototype Widgeon G-ALIK, illustrating the completely redesigned front fuselage which is of constant width. The initial batch will include two further machines.

A pleasing air view of the first Leonides Major Whirlwind, XJ396 (ground view of engine installation at foot of page). A second such installation is shortly to be made for type-test purposes at Yeovil.

WIDGEON AND WHIRLWIND . . .

minor improvements are being made. Eventually a spring feel system with control trimmers is to be added. A cabin-heater system is also to be fitted at a future date, the ducting for which is built-in to the cabin underfloor.

The weight penalty of the new rotor hub has been almost exactly balanced by a weight saving in the new nose structure, if the Dragonfly and Widgeon are compared to the same standard. Thus the empty weights are approximately equal, and the increase in gross weight from 5,700 to 5,900 lb can be utilized almost entirely for the extra payload, which gives a civil five-seater.

For Service use, the most useful features of the Widgeon are (1) the ability to rescue a crew of three persons (using winch and crewman). This was not possible in the standard Dragonfly due to the c.g. movement; (2) its possible use as an ambulance machine, carrying two standard general-service stretchers (loaded through the port nose-door) and medical attendant; (3) the side-by-side seating and dual control for pilot training.

As mentioned earlier, a large proportion of the existing Dragonfly has been retained in the design of the Widgeon, and the changes are such that the modification of Dragonfly aircraft to Widgeon standard is considered a practical proposition. A detailed scheme for such modification has been devised by the company.

At Yeovil, the second Widgeon is now almost complete. It is G-AKTW, originally the first S-51 to be built by Westlands, and it is to be followed by a third Widgeon, the front fuselage for which is now under construction.

Whirlwind Mk. 5 (Alvis Leonides Major).—At Yeovil, the Leonides Major-powered Whirlwind Mk. 5, XJ396, has logged some thirty hours' running time, over half of which has been in the air. The object has been to produce a Leonides installation which is a complete engine-change unit, enabling the Pratt and Whitney R-1340 Wasps and Wright Cyclones of earlier Whirlwinds to be replaced easily in future by the Alvis unit, which is to become the standard Whirlwind powerplant.

Compared with the Cyclone-powered Whirlwind Mk. 3, the rotor speed of the Mk. 5 is the same; the engine speed-range is different and so the reduction gearing has been altered. Only 720-750 h.p. of the Major's 870 h.p. is used normally at sea level in this installation, of which some 60 h.p. is used to drive the cooling fan. Maximum power is maintained up to 4,000ft under standard conditions, and the power benefit is of course available for operations in tropical countries.

Helicopter versions of the Leonides Major are basically similar to those employed in fixed-wing aircraft, except that they have no aircrew reduction gearbox. The Whirlwind version (A.Le.M. 5-10) is different from that used on Bristol helicopters in having opposite direction of rotation. Aft of the firewall, in the Whirlwind installation, the Mk. 5 is no different from the Mk. 3 except for the reduction gear.

A specimen of the Leonides Major intended for Whirlwind use is at present undergoing 50 hours of type-test bench-running at the Alvis factory in Coventry. When these tests are complete, this engine is to be fitted into another Whirlwind at Yeovil for further type-testing of transmission, etc. (involving 50 hr ground-running and 50 hr in flight). This will be followed by the fitting of subsequent Leonides Majors to a proportion of the Royal Navy's Whirlwinds.

The company anticipates clearance for the Whirlwind Mk. 5 at 7,800 lb gross weight in the spring of 1956, and for the civil version, the S-55 Series 2, at the same weight in the summer.

Subject to satisfactory completion of the type test, the Alvis Leonides Major should enter service in the Whirlwind Mk. 5 with an overhaul life, as on most new powerplants, of some 250 hr.

WESTLAND WIDGEON (civil version) (Alvis Leonides 521/1 engine)

Weight empty	4,378 lb
All-up weight	5,900 lb
Disc loading	3.10 lb/sq ft
Power loading	11.35 lb/b.h.p.
Flight limit load factor	2.84g
Design sinking speed	12ft/sec
Overall length, unfolded min.	45ft 6in
Height	12ft 11¼in
Wheel track	12ft
Wheelbase	10ft 1in
Rotors	**Main** / **Tail**
Rotor diameter	49ft 2in / 8ft 5in
Disc area	1,900 sq ft / 55.6 sq ft
Tip speed at 3,000 r.p.m.	520ft/sec / 586ft/sec

Engine details:

Alvis Leonides 521/1 (4½ lb boost)

Five-minute rating	520 b.h.p. at 43in. Hg. at 3,000 r.p.m.
One-hour rating	470 b.h.p. at 38in. Hg. at 6,000ft at 2,900 r.p.m.
Max. weak mixture cruise	375 b.h.p. at 31in. Hg. at 11,750ft at 2,800 r.p.m.

Alvis Leonides 523/1 (8 lb boost)

Five-minute rating	560 b.h.p. at 46in. Hg. at 3,000 r.p.m.

Performance at 5,900 lb with Alvis Leonides 521/1

Normal cruising speed at sea level	70 kt T.A.S.
Max. permissible speed at sea level	90 kt T.A.S.
Best rate of climb at sea level	960ft/min
Vertical rate of climb at sea level	170ft/min
Hovering ceiling (free air)	4,800ft
Hovering ceiling (10-ft wheel clearance)	7,500ft
Service ceiling (100ft/min R.O.C.)	10,000ft
Cruising fuel consumption	22 gal/hr
Still air range (full fuel 83 gal)	260 n. miles

WESTLAND WHIRLWIND (ALVIS LEONIDES MAJOR A.Le.M. 5-10)

Performance data (based on standard I.C.A.N. conditions, including the effect of a four-per-cent drop on normal engine power; maximum all-up weight for civil operations, 8,000 lb).

All-up weight	7,500 lb	8,000 lb
Max. permissible T.A.S. (sea level)	95 kt	95 kt
Normal cruising T.A.S. (sea level)	75 kt	75 kt
Best sea-level rate of climb:		
Using one-hour power	1,035ft/min	825ft/min
Using max. contin. power	775ft/min	577ft/min
Fuel consumption (at 75 kt)	35 gal/hr	39 gal/hr
Service ceiling	14,500ft	12,500ft
Hovering ceiling (10ft wheel clearance)	9,000ft	7,000ft
Max. range with standard tankage (no allowances)	320 n. miles	300 n. miles

Dimensions:

Length	42ft 0in
Main rotor diameter	53ft 0in
Height (main rotor)	13ft 2¼in
Height (tail rotor)	15ft 5¼in
Main wheel track	11ft 3in
Nose wheel track	4ft 8in

Pilot protection at

8g

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CIVIL AVIATION

SUSPENSION OF AIRWORK ATLANTIC

AS briefly reported in last week's issue of *Flight*, the cancellation of their North Atlantic all-freight service was announced by Airwork, Ltd., on December 15th. Known as Airwork Atlantic, the service had been operated by leased aircraft of U.S. registration since March 1st this year, though Airwork were on the point of taking delivery of, and introducing, their own fleet of three DC-6A freighters.

Announcing this decision, the firm stated that a considerable measure of success had been achieved in the first nine months of operations. The statement added, however, that "initial expectations of this route have not been fulfilled due to the prevailing restrictive conditions which now seem likely to continue. In these circumstances, the Board have reluctantly come to the conclusion that they are no longer justified in continuing this commitment."

The combination of circumstances which led to the abandonment of the North Atlantic service, as outlined by Mr. M. D. N. Wyatt, Airwork's chairman, is summarized below:

Airwork, alone among North Atlantic operators, were precluded by Government policy from carrying mail. Carriage of Atlantic mail was restricted to B.O.A.C. and to foreign carriers serving Britain under bilateral agreements. This restriction was known to Airwork when they started operations but there were precedents which led them to believe that it might be relaxed. Moreover, the G.P.O. had informed Airwork that they wished to use their services, but Government permission had not been forthcoming.

To make the most economical use of their aircraft, Airwork required to be able to operate passenger charters, but to do so they needed the permission of the U.S. Government. This could only be obtained through the British Government, who had refused to take the necessary action on Airwork's behalf. Pan American and K.L.M., two of their main competitors, had operated nearly 400 passenger charters over the Atlantic during the past year.

The company's licence included Milan and Stuttgart, but the Government had not negotiated the necessary traffic rights on Airwork's behalf and there had been a long delay in obtaining traffic rights for Dusseldorf.

Under current British regulations, imported aircraft were subject to a 20 per cent duty if their wing span was over 120ft, so that B.O.A.C.'s Constellations and Stratocruisers were exempted but Airwork's DC-6As were not. Duty on the three aircraft alone excluding spares would have amounted to £250,000. Airwork had applied for exemption from this duty and it had been granted by the Board of Trade only two days before the decision to suspend the service.

"Not one pound" of British Government cargo from America to Britain had been given to Airwork though the company was the country's official flag carrier on the route. Despite repeated requests the Government had refused to set up a free trans-shipment zone for freight at London Airport. As a result, much traffic which otherwise would have moved *via* London had been diverted to Continental airports such as Amsterdam and Frankfurt.

Airwork had expected that the service would lose money at first and though losses were in fact heavier than expected this was not the main reason for suspending the service. The company doubted if, under existing Government policy, the service would ever break even.

No details of the sale of the DC-6As are yet available. Since these aircraft are at a premium it is likely that the profit made on their sale will cover a substantial proportion of Airwork's loss. If, however, a change of Government policy allowed Airwork to return to the route their lack of suitable equipment would once again put them at a severe disadvantage against such competitors as Pan American and Seaboard and Western Airlines.

It is now being asked whether B.O.A.C. might apply for Government approval to fill the vacancy left by Airwork. The Corporation's official reply to this question, so cautiously worded as to be almost meaningless, is as follows: "Agreement between Airwork, Ltd., and B.O.A.C. relating to the North Atlantic cargo service has existed since before the start of that service. Conversations have recently taken place to explore the possibility of extending its scope by some form of closer working association but under existing circumstances this has been found impracticable."

The Airwork decision may well bring to a head the deep resentment felt by the independent airlines against the Government's half-hearted implementation of the "new deal" policy announced in 1952. At that time freighting was singled out as a sphere of activity in which the Government were anxious to encourage increased participation by independent operators. Private airlines responded well to this invitation, but licences have not only been difficult to obtain but, when granted, have often been so riddled with restrictions as to be of little commercial value.

The leaders of the independent airline industry are not alone in their belief that the Government has done too much to protect the Corporations and too little to carry out their policy of giving "greater opportunities to private enterprise." There is a growing feeling in the manufacturing industry that, given the chance, the independents would provide a bigger market for British aircraft.

The time seems ripe for the Government to review existing policy and at least to consider the possibility of changing legislation which gives the Corporations a monopoly of virtually all worthwhile routes. It is unfortunate that last week's Commons debate (page 982) yielded so few clues as to the Government's intentions in this matter. The fact that direction of civil aviation affairs has changed hands for the fourth time in 3½ years does not encourage hopes of an early answer to this increasingly urgent question.

BRITISH AIRPORTS INVESTIGATED

DURING the eight years between April 1st, 1948, and March 31st, 1956, a sum of £80m will have been provided by Parliament in the form of Estimates for civil aerodromes and ground services in the United Kingdom. Last spring, Parliament appointed a Select Committee to examine the way in which this money has been spent. In the course of its enquiry the committee called witnesses from the Ministries, government departments and airlines, and its first report, a most comprehensive 300-page document, has now been published by the Stationery Office. A brief summary of the findings and recommendations follows. It is hoped to include a fuller summary in a later issue.

The committee recommends that an effort should be made by the Ministry to produce trading accounts, as with other commercial undertakings operated by a government department.

Joint-user facilities between the civil flying departments and the service departments should, in the view of the committee, be reviewed forthwith, and, in addition, municipalities should be encouraged to own and operate their airports (as Manchester do already), while the Treasury, it is suggested, should give immediate consideration to the system of financing capital expenditure on civil aerodromes.

The question of attracting increased traffic to Ministry aerodromes "should be reviewed forthwith." Figures of increased traffic at Manchester compared with Ministry aerodromes "suggest that the Ministry's passive policy of not trying to attract traffic may be detrimental both to Exchequer and taxpayer."

An increase in landing fees is recommended, in view of increased costs and continuing losses, despite additional traffic.

Furthermore, the passenger service charge should be reviewed with the object of setting the basic rate higher and allowing the same rebates and surcharges to apply to landing fees.

Among the committee's other recommendations is a proposal that expenditure on amenities at airports should be borne by private enterprise.

JAPAN BUYS DC-8s

IT was reported last week that Japan Air Lines have ordered four DC-8s for their trans-Pacific service between Tokyo and San Francisco. Delivery is due to begin in September 1960 and to be completed by March 1961. The Japanese order, coming only six months after the announcement of Douglas's decision to build the DC-8, brings the number of these aircraft now sold to 99.

SEVEN SEAS FOR PANAIR

ACCORDING to a report from New York Panair do Brasil have abandoned their plan to acquire Comets and have decided instead to purchase four DC-7Cs. "With the approval of the Brazilian government," the report adds, "the amount of £759,000 already deposited in England as down payment on Comet 2s will be transferred to the U.S. and applied against first instalment payments on the DC-7Cs, the total cost of which will be £4,357,000."

BRANIFF BUY ELECTRAS

AN order for nine Lockheed Electras—costing, with spare engines and parts, some £8m—was announced on December 16th by Braniff International Airways. The order brings to 84 the number of Electras now sold by Lockheed; previous customers are American Airlines (35) and Eastern Airlines (40, with an option on 30 more). It represents the third stage of Braniff's £30m fleet expansion programme. Last March the company ordered seven DC-7Cs for delivery in September 1956, and earlier this month it placed an order for five Boeing 707s.

The Braniff version of the Electra will be fitted out to carry 66 first-class or 91 tourist-class passengers or 75 passengers in a combination layout. It will be powered by Allison 510 turboprops, which have also been specified by American and Eastern.

MORE CONTINENTAL VISCOUNTS?

AT the press conference held in New York to announce the purchase of 12 Viscounts by Continental Air Lines, Mr. Robert Six, president of the company, said that Continental had taken out a six-month option on three more Viscounts. They hoped to have seven of the new aircraft in service by July 1958. The Viscount would be introduced on the route linking Chicago, Kansas City,

This "semi-V.I.P." Viscount, due for delivery this week, is the first of two ordered by the Indian Air Force. Shown at left is its small "conference cabin," and the doorway leading into the 28-seat rear cabin. The second I.A.F. Viscount will be a full-luxury V.I.P. communications aircraft for transporting the President and Prime Minister.

CIVIL AVIATION . . .

Denver, and Los Angeles, taking the place of the Convair 340s now used. "Any airline now using the Convair 340," Mr. Six commented, "can and should take a look at the Viscount."

Speaking for Vickers, Mr. Charles Gardner said: "A good half dozen American airlines have already taken an active interest in our Viscounts. Nobody is waving any fountain pens at us now, but there is a good possibility of selling more in the United States; we think no other aircraft can do the job of the Viscount."

Mr. Six is expected to come to England in February to set up the first stages of Viscount and Dart conversion training for Continental flight and ground crews.

METROPOLITAN PROGRESS

CONSTRUCTION of the 53 Convair 440 Metropolitans now on order is reported to be proceeding on schedule at the manufacturer's San Diego factory. Delivery of the largest single order, that placed by S.A.S. for eleven Model 440s, is due to begin in March. As delivered to S.A.S., the aircraft will accommodate 52 passengers but will be convertible to a 44-seat version by the installation of a removable bulkhead in the forward cabin area. Among the measures taken to give the Metropolitan "the quietest passenger cabin of any modern transport" will be the fitting of double glass on all windows, with inner panes mounted in rubber.

T.A.A.'s VISCOUNT ANNIVERSARY

ON December 18th, Trans Australia Airlines celebrated the first anniversary of the introduction to scheduled service of their Viscount fleet. During their first year of operation the T.A.A. Viscounts have carried more than 230,000 passengers at an average load factor of 86 per cent and have made a total of 6,263 flights. In addition, they have set up no fewer than 16 airline records on Australian routes. Of the remaining nine records recognized by the Department of Civil Aviation, T.A.A.'s Convairs hold five. The airline now has five Viscounts in service and six more on order, of which one is due for delivery next month. Three more are expected to go into service by May 1956 and the remaining two are due for delivery early in 1957.

MORE SUPER CONNIES FOR SEABOARD

THE number of L.1049H Super Constellations ordered by Seaboard and Western Airlines has been increased from two to five. With spares, the extra aircraft are valued at $6.3m (£2.5m); delivery of the first of the five is due in December 1956, the others following at monthly intervals. With a gross weight of 137,500 lb, the new H version of the Super Constellation will be the heaviest of all civil freight aircraft. Wing-tip tanks will increase its total fuel capacity to 7,750 U.S. gal, giving a still-air range of 5,580 miles. On the North Atlantic route it is expected to carry payloads of up to 19 short tons—one ton more than the L.1049D freighter now in service with Seaboard (the company has four of these aircraft, together with five DC-4s).

According to Seaboard's president, Mr. R. A. Norden, Super Connies achieved an average utilization of 9.9 hours daily during the ten-month period ended October 31st. Experience of the aircraft, he said, had reaffirmed Seaboard's conviction that it provided "a good economic vehicle for developing the freight business."

BRITANNIA AND COMET PROSPECTS

IN a Christmas message to the staff of B.O.A.C., Sir Miles Thomas reported that the Corporation made a surplus of £268,000 in the first 32 weeks of the current financial year. Revenue had increased by £3,127,000 but costs had increased more steeply—by £3,520,000—and the result was a decreased surplus. There were three reasons for this: the load factor had dropped by 4.6 per cent to 61.1 per cent; the extra 26 per cent of capacity offered by the Corporation had been expensively obtained, due to the high price made for second-hand Constellations and Stratocruisers; and costs had increased all round—particularly wages, fuel prices and engine overhaul charges. Sir Miles warned the staff of B.O.A.C. that "the next twelve months will require all our courage and energy." There was nothing disheartening about the situation but they must pay most careful regard to B.O.A.C.'s financial position, which inevitably reflected the setbacks suffered by the fleet programme during the last eighteen months.

B.O.A.C. hoped that by Christmas the Britannia 100 would have qualified for its C. of A., enabling two aircraft to become available for crew training and route familiarization. The earning capacity of the aircraft, however, would not come into operation during the current financial year. "But I am sure you will be encouraged to know," said Sir Miles, "that our captains who have flown the aircraft on the factory proving flights all told me at a meeting I had with them recently that they were wholly confident of the high potential qualities of this aircraft. They like its quietness, its speed, and they sense that its general characteristics are such that it will attract traffic in a dominating fashion."

Referring to recent talk about the competitive threat of foreign jet transports, Sir Miles said it was always wise on these occasions to probe down to the truth of promotional statements and to sift wishful thinking away from realistic probability. "I still believe," he continued, "that the Comet 4 can be the first civil jet aeroplane to go into international passenger-carrying operation again. The key to the jet situation is engine availability, and from what we know there is every indication that the Rolls-Royce Avons will be flying in the Comet 4 on passenger routes before other engine

Studying a possible opening for the Conway are two Rolls-Royce executives—Mr. A. C. Lovesey, chief designer (centre), and Mr. F. T. Hinkley (right). Conducting them on their tour of the Boeing 707 prototype is Mr. H. W. Withington, a Boeing technical staff engineer. "A number of airlines," Boeing report, "have shown interest in a 707 design incorporating the Conway."

manufacturers can make the necessary deliveries to competitive airframe builders overseas. . ."

The basic need of Atlantic aircraft, said Sir Miles, was duration and range: "That is why we look on the first phase of this non-stop transatlantic proposition very much in terms of the turboprop Britannia and long-range conventional Seven Seas aircraft. I shall be very surprised as well as disappointed if British jet engine development over the next two or three years does not result in improved specific fuel consumption which, in engines of the Conway type, will make a transatlantic jet operation far more feasible than it looks today." What B.O.A.C. wanted was "a civil jet aeroplane that is versatile enough to cover our whole route pattern, is less demanding in its aerodrome requirements than the current designs of projected jets, is quieter, and which takes full advantage of the undoubted merits of the Conway type of by-pass jet engines."

FAIRCHILD FRIENDSHIPS

PLANS for licensed production of the Fokker F.27 Friendship in the United States reached an advanced stage on December 16th, when the following statement was issued by the Fairchild Engine and Airplane Corporation. "Immediate start of conversion engineering on the F.27 Friendship turboprop transport by the Royal Netherlands Aircraft Factories Fokker has been authorized under the terms of its option agreement with Fokker by the Fairchild Engine and Airplane Corporation. Richard S. Boutelle, Fairchild's president, said the procedure would enable Fairchild to maintain delivery dates for the 36-passenger transport, starting the latter part of 1957. Fairchild holds manufacturing sales rights for the F.27 in North and South America (with the exception of Brazil), and the accelerated engineering programme is within the scope of the Fairchild-Fokker agreement for U.S. production of the airplane."

Recalling that the Friendship made its first flight on November 25th and had completed ten flights by December 10th, the statement adds that "a 45-minute test hop was made with R. A. Henson, Fairchild's manager of flight test, at the controls." He reported that the Friendship had "excellent flight characteristics."

Fokker's F.27 Friendship displays its high wing and neat Dart installation in this frontal view of a touch-down at Schiphol. News of possible American production of Friendships is given on this page.

BREVITIES

A THIRD de Havilland Heron has been ordered by British European Airways for passenger/ambulance service on their Western Isles routes. Two Heron 1s have been used on these routes by the Corporation since March 1955.

* * *

Capt. J. W. G. James, flight operations director of B.E.A., has succeeded the late Mr. A. A. Priester as chairman of the I.A.T.A. Technical Committee.

* * *

Under an agreement with the M.T.C.A., International Aeradio, Ltd., are taking over the operation of the aeronautical fixed telecommunication circuits and radio beacons at Kuwait Airport, Persian Gulf.

* * *

Recent visitors to the Bristol Aeroplane Co. works at Filton have included representatives of the Italian airline L.A.I. and of Japan Air Lines. Members of both companies made demonstration flights in a Britannia.

* * *

Three DC-4s of South African Airways have been fitted with different types of nose-mounted storm-warning radar. By this means the airline hopes to decide on the type to be fitted as standard equipment on all S.A.A. aircraft.

Mr. Stuart G. Tipton will take office as president of the Air Transport Association of America on January 1st. For the past 11 years Mr. Tipton has been general counsel of the Association and for the previous six years was assistant general counsel of the Civil Aeronautics Authority.

* * *

A delegation of members of the Belgian Parliament, accompanied by several British M.P.s, recently visited the Weybridge works of Vickers-Armstrongs (Aircraft), Ltd. Among places covered by the visit were the two new Viscount erecting shops, at Weybridge, now approaching completion, from which aircraft are already being produced.

* * *

The interline agreement signed recently in Moscow between B.E.A. and Aeroflot came into force on December 19th. Through tickets to Russian destinations can now be bought at any B.E.A. ticket office or travel agent in the United Kingdom. The single fare for an air journey between London and Moscow (normal routing is *via* Helsinki) is £74 4s and a return ticket costs £133 12s.

* * *

A bilateral agreement providing for reciprocal air services between Australia and Japan was signed in Tokyo last month. Under the terms of the Peace Treaty with Japan, Qantas have been operating services to Tokyo for the past five years; these rights, which would otherwise have expired next April, are continued in the agreement. It is understood that Japan does not intend at present to exercise her right to operate reciprocal services.

* * *

An African correspondent reports that, due to wage increases in the manufacturing industry, the price of the five Viscounts ordered by Central African Airways has increased from £1,350,000 to £1,470,000; the cost of spares, originally estimated at £579,400, will increase by £15,000. Modification of the aircraft to suit Rhodesian conditions is expected to cost £75,000 and freightage of spares a further £50,000. Of the total cost of the Viscount programme £1,750,000 is being lent by the Colonial Development Corporation, the balance of £376,400 being provided by the Federal Government and C.A.A. Delivery of the first aircraft, originally expected in November, is now due in March or April next.

TEST TANK Mk 2

(continued from page 959)

gust histories. (If gust-force is plotted against number of reversals-to-failure, the point at which the appropriate S/n curve approaches closest to the resultant line is found to be equivalent to a 10ft/sec gust). This force is 25 per cent of the Comet 2 wing's ultimate strength, plus or minus 8 per cent.

The four-minute loading cycle is as follows: Ten gusts with fuselage unpressurized representing take-off and initial climb; four gusts during which fuselage pressure builds up to a maximum differential of 8¼ lb/sq in, representing normal climb; four gusts at full pressure differential representing high altitude cruise; six gusts during which fuselage pressure differential falls from maximum to zero, representing descent.

Finally the flight loads are removed and the aircraft sinks back on its undercarriage. The speed with which each cycle can be completed is limited by the swirl of water in the tank. The complete sequence is presented by pressure gauges and indicator lights in the control room (see photograph, p. 958).

Very careful precautions have to be taken to ensure that the expensive test specimen is not inadvertently damaged, and that inaccurate readings are not taken. For example, filling the tank with a thousand tons of water has to be done so that the levels inside and outside the fuselage are the same; quite a small difference in "head" could break the specimen. Care has to be taken that as little air as possible is trapped in the fuselage, and that loading compensation is made for buoyancy of the nosewheel bay and the rear, non-pressurized fuselage section (see photograph). Air spaces in window sandwiches are suitably vented; wing rib No. 2 is reinforced to withstand a 10ft head of water pressure; means are provided for collecting water leaking from the tank *via* the inside of the wing; and duplicated limit-switches in the fuselage stop the pumps in the event of over-pressure.

A small Budenberg recorder in the control room graphically traces each cycle until a failure occurs—or, as the de Havilland test crew prefer to put it, until it runs out of ink.

Changes in the Air at Westminster

AN impression that Conservative opinion is thinking in terms of a further re-shaping of civil aviation was sustained, though not supported by any definite utterance, during a debate in the House of Commons on Monday dealing with the accounts of the two Corporations. It was certainly aware that change was in the air *vis-à-vis* Ministerial representation, and by the time the debate was over it was fairly common knowledge that Mr. Boyd-Carpenter, in winding-up the debate, was doing so for the last time as Minister of Transport and Civil Aviation. (See "The New Ministers," p. 956.)

MR. J. D. PROFUMO (Parliamentary Secretary, M.T.C.A.), who opened the debate, laid much stress on the essentially dual nature of civil aviation as between the Corporations and the independent operators. While, therefore, he paid due tribute to the Corporations' activities, as shown in the two reports, he was careful also to note that the activities of the independent operators had increased by an even greater percentage than those of the Corporations. Mr. Profumo expressed the Government's regret that Airwork had decided to suspend their North Atlantic service. He hoped the word "suspend" was to be taken literally.

At a later stage in his speech, Mr. Profumo devoted some thought to the possibility of a Chamber of Air Transport, a body which would encourage greater integration of civil aviation both internally and also in relation to other forms of transport. This was a subject in which the Government had a considerable responsibility. They would always wish to support and further the Corporations, for every country must have its chosen flag carriers assisted by the State, but assisted only to the extent which was wholly necessary in the interests of all concerned.

Mr. Profumo at this point reminded M.P.s of the words of the Conservative election manifesto on civil aviation, which speaks of the need for a blend of public and private enterprise as the best for these services, and suggests that close co-operation between air transport and shipping can be of great value. But he stressed the need to transcend party differences in shaping aviation policy. Given that spirit, he said, "I firmly believe we can arrive at a pattern of development which will remain unchanged even if Governments change."

Dealing with B.E.A., he gave figures to show that the "fleet on order" had been increased to 58 aircraft by Government approval for the purchase of a further 16 Viscount Majors, and proposals to order 20 of the new Vanguards. (It is estimated that the orders will involve expenditure of between £20m and £25m.)

MR. FRANK BESWICK (Lab., Uxbridge) said that the executive position in the Corporations was very unsatisfactory, and he felt that some assurance should be given that it was going to be changed in the very near future. Here was a young and rapidly developing industry in which, surely, there should be young and air-minded executives ready to move up and take over important positions demanding replacement. It was a strange commentary that, ten years after the war, no employee had been given a chance to work to the top.

He did not think the change in the activities of Sir Miles Thomas was necessarily a bad thing, but, coming as it did in conjunction with the other changes, it meant that direction at the top was becoming looser rather than tighter.

On aircraft development, Mr. Beswick wondered whether any one company in this country was big enough to produce the type required in the long-range market. He suggested that two or three of the foremost firms in this country might be asked to get together on the sort of project now being contemplated.

CAPT. F. V. CORFIELD (Con., Gloucester South) suggested that it was out-of-date for the great air corporations, who had established themselves, to put a limit on the use of modern aircraft by independent operators on "colonial coach" services.

MR. GEOFFREY DE FREITAS (Lab., Lincoln) invited the Government to study the possibility of closer co-operation with European technicians to enable this country to compete with the enormous resources of the United States. This task was all the more important in view of the great potential of the North American transatlantic market, whence 250,000 tourists came to this country each year, not quite half of them by air.

DR. REGINALD BENNETT (Cons., Gosport and Fareham) did not think it was jumping too far ahead to start thinking of a supersonic project. His fear was that we were liable not to jump far enough; if the remarks of the chairman of B.O.A.C. were to be taken at their face value, we were going to be jumping backwards. (This was a reference to a recent speech in which Sir Miles Thomas said they looked to the British aircraft industry to assist in providing them with an airliner in the 500 m.p.h. class.)

MR. MAURICE EDELMAN (Lab., Coventry North) suggested there should be most energetic probing into the system by which public money was used for the development and production of aircraft. If one went to any of the major aircraft firms today, one found that, whereas the executive department was overloaded and inflated, the actual production part was deficient. There was no plan or policy in the industry; each company went its own way, but all tightly controlled by the S.B.A.C. This might well be an industry to refer to the Monopolies Commission.

MR. REGINALD MAUDLING (Minister of Supply), replying to this aspect of the debate, remarked that aircraft production was something like two-and-a-half times the size it was when Labour left office. It seemed clear that we got more results out of a given quantity of technical manhours than the Americans. While in many cases our production resources were under-employed or not overstrained, on the development side there was considerable strain on technical manpower and facilities.

Mr. Maudling then referred to a proposal by the Bristol Aircraft Co. to develop a successor to the Britannia in conjunction with firms in America. The company had consulted him at the right stage about his view, and he was now considering their proposals. Should the proposal be completed and carried on, arrangements would be made for the proper recovery to the taxpayers of the money invested in the B.E.25.

In considering our policy for the future, we must remember that, in order to sell in competition with the United States in world markets, we must produce something which was significantly better than what the United States could offer. That was why the triumph of the Viscount in America was such a remarkable achievement. The moral of all this, Mr. Maudling clearly believed, was to concentrate on building on the success we had, rather than disperse our effort too widely.

W/C. P. B. LUCAS (Cons., Brentford and Chiswick) said that a clear Government directive as to what the purchasing policy of B.O.A.C. should be was now required. The Government ought to make up its mind whether it wanted the Corporation to be a commercial concern buying its aircraft where it thought fit, or an organization committed to buy British only.

He suggested that the present Board of B.O.A.C. had, between them, very little experience of the operation of modern aircraft, and two more people with such experience should be appointed. Higher salaries were also needed for top executives in the Corporations.

MR. F. W. FAREY-JONES (Cons., Watford) suggested that the Government should form a financial corporation to buy and acquire the shares of both B.O.A.C. and B.E.A. The financial corporation should have in any airline in which it was interested a 50 per cent capital interest. Otherwise there would be "a continuation of the rot which had already started." He wanted to see every Commonwealth airline sending its executives to London at least once a year, planning ahead. If anybody thought the pioneering spirit could be released by keeping the whole of this vast enterprise of the future in the hands of one Board of directors, then we certainly deserved the failure which was already creeping upon us. Mr. Farey-Jones contended that since the war the "creeping paralysis" over British civil aviation was something that was appalling to anybody who cared to study it.

These forthright remarks produced little response from Mr. Boyd-Carpenter who, in replying to the debate, suggested that British civil aviation was entering upon a period of expansion and development.

EDGAR PERCIVAL P.9 (continued from page 972)

opposite side, and the static-balance tubes being changeable top and bottom.

The tailwheel on the prototype P.9 is a long-stroke rubber-in-tension unit operating on the parallelogram principle with a spring-loaded cam-operated mechanical shimmy-damper, and is fully retractable but not steerable. Production machines will have a simpler unit, incorporating a rubber-in-compression strut.

Future Prospects.—As mentioned, a topdressing hopper is to be fitted to the prototype P.9 in the near future. Production machines, however, may be supplied to customers simply with removable floor and roof sections to the freight cabin, if required, in order to accommodate particular installations. A number of orders, dependent only on the prototype meeting its estimated performance, have been received for production versions of the P.9. These orders have come from New Zealand although, as indicated earlier, the new Edgar Percival aircraft has been designed to fit in to outback work in many other Commonwealth countries.

Work has already started on a production batch of ten aircraft, in order to accelerate deliveries after the type certificate and certificate of airworthiness have been obtained on the prototype P.9. A demonstration tour of Australia and New Zealand is expected to begin in March or April 1956.

The following list, supplied by the manufacturer, gives the names of suppliers of raw materials, components and equipment for the P.9:—

Accles and Pollock, Ltd.; AC-Delco Division of General Motors, Ltd.; Aerocontacts, Ltd.; Aircraft Materials, Ltd.; Amal, Ltd.; Aviation Developments, Ltd.; Thos. Boorn and Co., Ltd.; Bound Brook Bearings, Ltd.; Bowden (Engineers), Ltd.; British Aluminium Co., Ltd.; British Oxygen Co., Ltd.; Bruntons (Musselburgh), Ltd.; Renold Chains, Ltd.; Curd Components, Ltd.; De Havilland Aircraft Co., Ltd.; Docker Brothers; Dunlop Rubber Co., Ltd.; Faulkners, Ltd.; Ferodo, Ltd.; Goodyear Tyre and Rubber Co. (Great Britain), Ltd.; John L. Green (Engineers Merchants), Ltd.; Hartzell Propeller, Inc.; Thos. P. Headland, Ltd.; E. and E. Kaye, Ltd.; Ki-gass, Ltd.; Litco Flight Aids; Low Moor Iron Co., Ltd.; Lycoming Division, Avco Manufacturing, Inc.; The Manganese Bronze and Brass Co., Ltd.; Wm. Mallinson and Sons, Ltd.; Henry Meadows, Ltd.; Murphy Radio, Ltd.; Nettlefold and Moser, Ltd.; Northern Aluminium Co., Ltd.; Oddie, Bradbury and Cull, Ltd.; J. Penny and Sons; Peto and Radford; Walter Potter, Ltd.; Ransome and Marles Bearing Co., Ltd.; Reynolds Tube Co., Ltd.; H. Rollet and Co., Ltd.; Sangamo Weston, Ltd.; The Skefco Ball Bearing Co., Ltd.; S. Smith and Sons, Ltd.; Suntex Safety Glass Industries, Ltd.; Superflexit, Ltd.; T.I. Aluminium, Ltd.; Tufnol, Ltd.; A. J. Walter, Ltd.; Vickers-Armstrongs, Ltd.; W. Wilson and Sons, Ltd.; Woods Sons and Co., Ltd.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

Snr. U/Off. M. J. Griffith (left) and Snr. U/Off. G. C. Hubbard won the Sword of Honour and the Queen's Medal for Cranwell's No. 66 Entry.

C.F.E. Canberras Return

TWO Canberra P.R.7s of the Central Fighter Establishment recently returned to West Raynham after completing one of the Establishment's regular visits to the air forces of the Commonwealth. Taking off from West Raynham at the beginning of November, the Canberras flew out to Australia *via* Abu Sueir, Karachi, Colombo, Singapore, Darwin and Melbourne. The crews were led by A. Cdre. J. Grandy, C.F.E. Commandant, and consisted of S/L. C. K. Cooke, S/L. R. D. Coleman, W/C. R. B. Cole (captain of the second aircraft), S/L. K. L. Charney and F/L. B. de Iongh.

Belgian Squadron Commander

AN officer of the Belgian Air Force, Major J. E. H. Kaisin, is to command No. 56 Sqn. at Waterbeach. The appointment has been made under an exchange scheme between the Belgian Air Force and the R.A.F. which has been in operation for several years. An R.A.F. officer already commands a Belgian Meteor squadron, and this is the first occasion on which a Belgian has been appointed to command an R.A.F. squadron. No. 56 Sqn. is equipped with Hunters.

Queen's Commendation

THE Queen's Commendation has been awarded posthumously to Lt. M. W. Winfield, R.N., of No. 806 Sqn., F.A.A., who lost his life at Kingston Gorse, Sussex, after his Sea Hawk suffered engine failure. Lt. Winfield, realizing that he would be unable to make an emergency landing at Ford, headed towards the coast. He remained with his aircraft until it had cleared a built-up area and people on the beach, and then ejected at 100ft. He subsequently died from his injuries.

Sarah in Service

THE miniature search and rescue and homing beacon "Sarah," developed by Ultra Electric, Ltd., which can be carried in a Mae West is now in service with the R.A.F. Search aircraft, helicopters and air/sea rescue launches are fitted with the homing receiver which will allow accurate pin-pointing for ditched airmen at ranges up to 70 miles. When mounted in a launch, the receiver will give an indication of the beacon's position accurate to within a few feet, so that a rescue can be made by this means even in zero visibility. Sarah also has a speech transmission and reception facility which allows voice communication with the rescuer during the final stages of a pick-up. The beacon will transmit continuously for many hours and is automatically switched on by the removal of the cover of its flexible aerial.

Mascot Promoted

A SKEWBALD Shetland pony, the mascot of the Aircraft Apprentices' Wing, R.A.F. Locking, has been promoted to leading aircraft apprentice after 21 months' service. The single chevron of his new rank was pinned on his blue-and-grey saddlecloth by W/C. S. Linnard, O.C., No. 1 Apprentice Wing. The pony, called Hamish McCrackers, is ostensibly on a 30-year regular engagement in the Apprentice Wing. Promotion to junior technician is expected for him after satisfactory completion of three years' service.

R.A.F. Gliding Year

THE R.A.F. Gliding and Soaring Association has had its best season to date. In the eight clubs there were 15,082 launchings, and 1,389 gliding hours were logged. These figures for the first time exceed those of the 2nd T.A.F. Gliding Association; and they do not include gliding by R.A.F. personnel with civil clubs. Members number about 600 and glider strength is 47, including Olympias, Kranichs, Sedbergh and Cadets. During the year, 94 "A", 89 "B", 46 "C" and a number of silver "C" gliding certificates were awarded.

R.Aux.A.F. Appointment

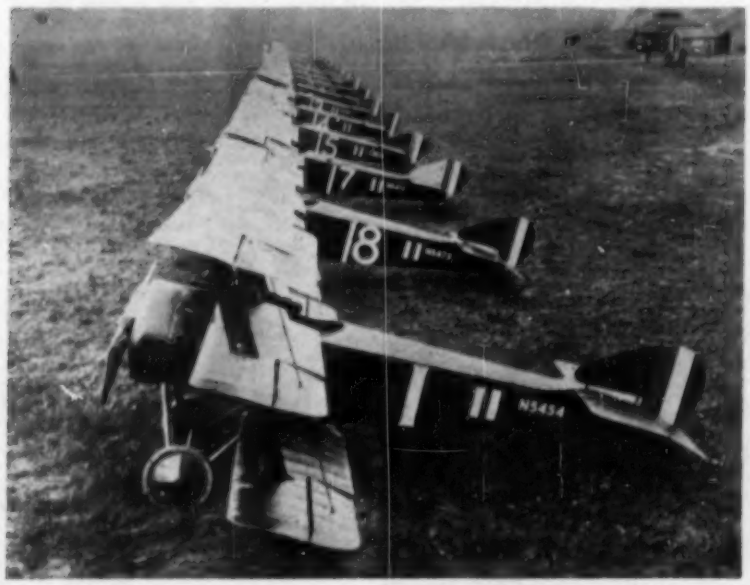
IT has been announced that S/L. R. E. Tickner, R.A.F., is to command No. 605 (County of Warwick) Sqn., R.Aux.A.F., at R.A.F., Honiley.

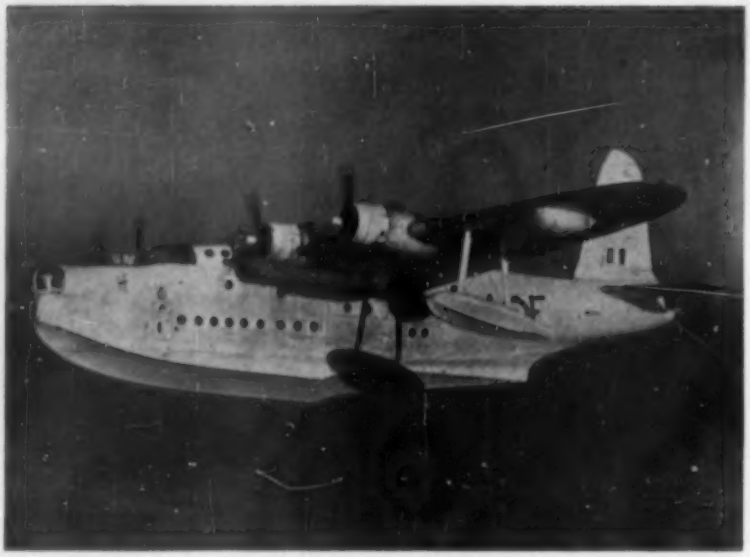
S/L. Tickner flew Hurricanes with No. 32 Sqn. in England and North Africa during the war, and later served with No. 111 Wing and Nos. 122 and 65 Sqns. At the end of the war he was a test pilot at an M.U., and carried out test and ferry duties at home and in Germany. In 1949 he went to a Mosquito A.F.S. at Brize Norton, before graduating as a test pilot at Farnborough in 1952, and serving at Boscombe Down until November this year.

Met. Office Signals Traffic

THERE has been an increase of nine per cent during the last year in signals traffic at the Central Forecasting Office at Dunstable. Weather information is transmitted either by radio or teleprinter in five-figure code groups. On one specimen day in 1955, 542,755 groups were transmitted and received, as opposed to 497,096 on the same day in 1954.

A recent acquisition by the Imperial War Museum is this excellent picture of the Sopwith Triplanes of No. 1 Sqn., R.N.A.S., at Boilleul during World War I. The squadron was later redesignated No. 201 Sqn., R.A.F. An article concerning it appears elsewhere in this issue.





The traditions of the flying-boat are now maintained in the R.A.F. only by the Sunderland squadrons. Here "F Fox" of No. 201 Sqn., captained by F/L. K. Michelin, poses for "Flight's" camera.

SERVICE AVIATION . . .

R.A.A.F. 1914-18 Veterans

THE members of the Australian Flying Corps Branch of the Air Force Association recently visited the Flying Corps Memorial at Point Cook, where Australian military flying first began. It was in 1913 that the late Eric Harrison and H. A. Petre arrived from England with a Bristol Boxkite and a Deperdussin to begin the original flying school. Among the first four pilots trained in August 1914 was Air Marshal Sir Richard Williams, now Director-General of Civil Aviation in Australia and Federal President of the Air Force Association. He inspected the guard of honour during the ceremony and watched as four Wirraways flew in formation over the memorial.

Trans-antarctic Flight

A R.N.Z.A.F. squadron was to stand by at Bluff, the most southerly port in New Zealand, for possible rescue work in connection with the American trans-antarctic flight late this month. An American naval task force is involved in this flight and eight aircraft were to take off in two groups for Wigram, near Christchurch, and Taieri, farther south.

R.A.F. Rain-making

THE Water Board and County Council of Durham County requested the R.A.F.'s help in trying to bring rain to an area of 500 square miles suffering from drought. If the request had been met, Service aircraft would have been used to "seed" rain-bearing clouds.

St. Clement Dane's

THE church of St. Clement Dane's in the Strand, London, which is to become the official church of the Royal Air Force, is to be restored and A.V-M. Sir Cecil Bouchier is to launch the campaign for funds in the New Year. The church, which will seat 1,200 people, is to be rebuilt in its original Wren form. The decoration of the interior will include squadron badges let into the floor of the nave.

A complete memorial roll of honour of all the 125,000 names of R.A.F. men and women who have lost their lives since the Service was founded is being prepared, and the architect's drawings of the church will be deposited with the Royal Institute of Architects in case the need for rebuilding should arise once again.

The ancient bells, which were cracked in the air-raid fire which gutted the church in 1941, are being melted down and re-cast, and an electrical system is being installed capable of playing three tunes on them, including *Oranges and Lemons*. The new bells are expected to be ringing again next summer and work on the tower has already begun.

Royal Air Force Appointments

THE following continues recent lists of Royal Air Force appointments as announced by the Air Ministry:—

G/C. J. F. Newman, D.S.O., D.F.C., to H.Q., No. 22 Group, for air staff duties; G/C. J. D. Ronald, A.F.C., to the Air Ministry for duty in the department of the Air Member for Personnel.

W/C. P. H. S. Wood, O.B.E., to the Radio Engineering Unit, to command (with the acting rank of group captain); W/C. J. H. L. Blount, D.F.C., to the Ministry of Defence for staff duties; W/C. H. J. Cundall, D.S.O., D.F.C., A.F.C., to R.A.F. Wittering, for flying duties; W/C. P. Dennehy, to R.A.F. Milton, for administrative duties; W/C. F. E. Dudley, to H.Q., No. 90 Group, for technical staff duties; W/C. P. C. I. Elderton, to H.Q., No. 11 Group, for air staff duties; W/C. B. Everton-Jones, to R.A.F. Merryfield, to command; W/C. D. B. Gericke, to R.A.F. Sylt, for flying duties; W/C. J. V. Hoggarth, to R.A.F. Sculthorpe, to command, and as R.A.F. liaison officer with the U.S.A.F.; W/C. J. A. Holmes, D.F.C., to R.A.F. Wildenrath, for flying duties.

W/C. B. J. Jennings, A.F.C., D.F.M., to H.Q., Flying Training Command, for air staff duties; W/C. R. J. Kelsey, to R.A.F. Valley, for flying duties; W/C. P. G. H. Matthews, D.F.C., to the U.S.A.F., for flying duties; W/C. G. F. Morley-Mower, D.F.C., A.F.C., to R.A.F. Seaton Snook, to command; W/C. D. L. Prichard, D.S.O., to R.A.F. Mafraq, Jordan, to command; W/C. R. A. S. Ritchie, to H.Q., 2nd T.A.F., for administrative staff duties; W/C. R. G. K. Smith, to R.A.F. Wittering, for technical duties; W/C. R. L. Smith, to R.A.F. Wunstorf, 2nd T.A.F., for administrative duties; W/C. W. A. Smith, D.F.C., A.F.C., to R.A.F. Ouston, to command; W/C. W. D. Symes, to the Air Ministry, for duty in the department of the Air Member for Supply and Organization; W/C. G. Tate, O.B.E., D.F.C., to R.A.F. Bawburgh, to command; W/C. D. K. Warburton, A.F.C., to R.A.F. Barkstone Heath, for flying duties; W/C. A. C. Whitfield, M.B.E., to R.A.F. Wattisham, for technical duties.

S/L. R. Broadbent, D.F.C., to the Air Ministry, for duty in the department of the Air Member for Supply and Organization (with the acting rank of wing commander); S/L. T. W. Horton, D.S.O., D.F.C., to the Air Ministry for duty in the department of the Chief of the Air Staff (with the acting rank of wing commander); S/L. F. Ruskell, D.F.C., to the Air Ministry, for duty in the department of the Chief of the Air Staff (with the acting rank of wing commander); S/L. B. Spray, to R.A.F. Marham, for administrative duties (with the acting rank of wing commander).

A. Cdre. J. Grandy, Commandant of C.F.E., with his crew, are welcomed home to West Raynham by W/C. E. D. Crew, deputy commandant, after their return in their Canberra P.R.7 from Australia. The aircraft bears appropriate C.F.E. markings.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Britain's New Airliners

THE only way Britain will have success on world airline markets in the face of U.S. competition during the coming decade will be to produce transports so advanced in conception that there are no foreign competitors in a comparable field. We have already succeeded in this respect with the Viscount, and might well have done with the Comets 2 and 3 had our pioneer work in the pure-jet field been more fortunate.

Today, Britain has a trio of airliners which are very seriously threatening the U.S. market. In the Britannia, Comet 4 and late models of the Viscount we have an unbeatable combination in terms of performance, flying experience and delivery dates. Surely all our limited resources should be concentrated on these aircraft if we are to play the part we deserve in the markets of the future.

The V.C.7 project, however, would have had to struggle against two U.S. types, hardly inferior in performance, and which can offer earlier and, it appears, more definite delivery dates, combined with an incalculable factor of tradition and prestige. The Vanguard appears to be in a similar predicament. Although the Electra, its American competitor, is undoubtedly inferior in certain respects, this aircraft can offer earlier delivery dates, a comparable performance and possibly a more positive production schedule. Vickers would have been, and will be, hard pressed to repeat their Viscount successes with these two projects.

I am convinced that the recent Government decision to cancel the V.1000 and to concentrate on the designs which we have already proved successful is a sound move. Before Britain can compete with direct U.S. competition, she must build up a world prestige for realistic delivery dates and reliable aircraft designs. Once we have succeeded in firmly establishing this condition, the British aircraft industry can safely begin to attack the Americans on their own ground.

Malvern, Worcs. D. W. SUTHERLAND.

I MUST disagree most strongly with "Torquemada," whose opinions were quoted in his letter in your issue of December 16th. The market for true non-stop transatlantic aircraft, pure jet or turboprop, is so small in terms of numbers of aircraft, even if it sounds large in l.s.d., that only one manufacturer can hope to see a profit when the enormous developments costs of such a machine are taken into account. "Leave it to Douglas" is thus sound commercial practice—but with, one hopes, British engines.

Secondly, nothing, even the Vanguard, ought in any way be allowed to impede production of V.700 and V.800 Viscounts, whose sales appear limited only by too-lengthy delivery times.

There is no convincing evidence that Vickers ever really wanted to make the V.1000; but the V.900 Vanguard promises, with Viscount experience and success behind it, to fill a need in a potential market much greater than that for the V.1000 type of aircraft, and its background ought to lead to orders "off the drawing board" with much more confidence than for the Electra. As the Vanguard would appear capable of doing most of the things which the Britannia can do, plus a lot more, it is the Britannia, not the V.900, which may well become the white elephant.

Shenfield, Essex. J. RODGERS.

[Our correspondent overlooks the fact that the Britannia is intended for considerably longer stages than is the Vanguard; and, of course, it is already in production.—Ed.]

Tugs and Gliders

LIVING, as I do, close to Thame Aerodrome—and still flying from it occasionally—I enjoyed reading (in your issue of December 16th) of Mr. J. C. Edmunds' aero-towing experiences there during the war. I also flew the Hart variants in my time, but not on aero-towing duties. However, I would have expected the Hart to make an effective tug because of its "Bentley-with-four-wheel-brakes" characteristics which resulted from the combination of relatively high power with (on modern standards) high drag and which, incidentally, made it such a pleasant aeroplane for formation flying. Even towing the relatively heavy Hotspur, the Hart must have had a much better performance than the average light aeroplane/sailplane towing combination. The power loading, at training weights, must have been about 10 lb/h.p. compared with more than double this figure for a typical gliding club combination today.

Mr. Edmunds is right in assuming that many modern aero-tow quick-releases are operable at the hook and do not therefore require the co-operation of the pilot for hooking on. If pilot action is required, Mr. Edmunds' drill is probably the quickest and the most foolproof.

On the question of action in the event of engine failure, it is, of course, true that the glider will decelerate much less rapidly than the tug and will tend to over-run the cable. However, the important point is that the tug is flying close to the stall and in a high-drag attitude. It will therefore lose speed extremely rapidly if full-throttle thrust is suddenly lost, and a stall is extremely likely unless prompt corrective action is taken. Mr. Edmunds obviously appreciated this and took the right action when his Hector's engine failed on tow.

Ruislip, Middx. PETER W. BROOKS.

High-Altitude Ornithology

IN your issue of December 9th, Mr. Maurice Austin asks if vultures have flown at over 26,000ft. Although I cannot help his quest he may be interested in an incident occurring in March 1954.

At just over 20,000ft, near Ismailia, my aeroplane collided with a large bird which I believe to have been a vulture. During the short time which I had it in view it did not move at all, but appeared to be gliding in fairly tight circles. At the time, my navigator and myself came to the unsatisfactory conclusion that it had been carried to that height by a thermal and become unconscious. In the light of your correspondence, however, it seems that it was probably on a normal reconnaissance trip.

I wonder if any ornithologists can suggest the reasons for this particular form of high flying as opposed to the cross-country flights of geese, etc.; surely no food can be found at that height.

Bedford. J. H. ANSLEY.

Ejections at High Speed

MAY I, through your correspondence columns, be permitted to correct the statement, in your report on F/O. H. Molland's supersonic ejection [*Flight*, December 2nd, 1955] that "when he reached hospital his pelvis was also found to be broken."

A medical report which I studied on the injuries sustained by the pilot made no reference to a broken pelvis and Molland himself told me that his pelvis was not broken.

His fractured arm and facial injuries were probably due to his using one hand only to pull the firing handle, the right hand having been occupied with hood jettisoning. Having lost the protection of the hood the pilot was unable to get his right hand on to the firing handle and thus to anchor his hands and obtain the full protection of the face screen.

Had this ejection been made with a Martin-Baker Mk 3 seat —similar, say, to that at present installed in Javelin aircraft, in which the aircraft hood is explosively jettisoned by the operation of the seat firing control, to be followed automatically one second later by the ejection seat—I confidently believe that the escape would have been made without injury.

In this seat, also, the risk of injuries due to leg-flailing is eliminated by the automatic leg restraint which holds the legs together on the front edge of the seat pan during ejection.

Uxbridge, Middx. J. JEWELL,
W/Cdr. R.A.F. (Rtd.),
Martin-Baker Aircraft Co., Ltd.

FORTHCOMING EVENTS

Jan. 5. R.Ae.S.: Young People's Lecture: "Test Flying—Current Problems and Techniques," by W/C. R. P. Beamont, O.B.E., D.S.O., D.F.C., A.R.Ae.S.

Jan. 6. Helicopter Association: "Economic Production of Helicopters—Future Possibilities," by L. J. Harper.

Jan. 10. R.Ae.S.: Section Lecture: "Some Modern Structural Problems," by Prof. W. S. Hemp, M.A., F.R.Ae.S.

Jan. 12. R.Ae.S.: Presidential Address by N. E. Rowe, C.B.E., B.Sc., F.C.G.I., F.I.A.S., F.R.Ae.S.

Jan. 12-13. British Welding Research Association: London Meeting on Increasing Productivity by Welding.

Jan. 14. British Interplanetary Society: "Space Ship Instrumentation," by R. A. Weldron, B.A., Grad. Inst.P.

Jan. 14. Women's Engineering Society: New Year Luncheon.

R.Ae.S. Branch Fixtures (to January 10th):—

Jan. 2, Derby, Annual General Meeting. Jan. 3, Belfast, "Accident Proneness," by Dr. J. A. Smiley. Jan. 5, Isle of Wight, "Noise of Jet Engines," by F. B. Greatrex. Jan. 9, Glasgow, "Helicopters," by R. Harner. Jan. 10, Boscombe Down, "Fatigue—the Metallic Deathwatch Beetle," by D. C. Smith; Bristol, "Aerodynamics and Associated Problems," by R. F. Creasey.

THE INDUSTRY

Hawker Apprentices—and Old Timers

NINE former Sopwith apprentices—all of whom have risen to senior positions in the Service or industry—attended the recent apprentices' prizegiving of Hawker Aircraft Ltd., Kingston, where they watched the fifth annual presentation of the shield they had given to Hawker apprentices. The winner this year was R. C. Cannon, an engineer apprentice, who also won an award for obtaining the Higher National Certificate in the fourth year of his apprenticeship.

Prizes were presented to 16 of the 110 apprentices by Mr. Neville Spriggs, managing director.

The former Sopwith apprentices present were: A.V-M. L. T. Pankhurst, Director-General, Personnel (1), Air Ministry; W. W. Warner, chief engineer, Airwork, Ltd.; R. W. Sutton, director, R. W. Sutton Consultants Ltd.; M. C. Brothers (retd.); V. W. Derrington, managing director, V. W. Derrington Ltd.; H. Parsons, sales manager, Pirrelli Tyres; J. Williams, chief equipment engineer, London Transport Executive, Chiswick; Frank E. Buckell, manager, aeronautical department, General Electric Co., Ltd., Capt. H. D. Davis, managing director, Brooklands Aviation, Ltd.

Apprentices presented with prizes were: D. H. Cooper, A. M. Barrett, R. C. Cannon, A. H. Atkinson, R. R. Grenyer, J. P. Davie, J. C. Duncan, R. E. Jones, D. J. Goodley, A. E. Harris, R. B. Searle, P. J. Candfield, B. J. Cunnington, T. W. Howes, A. A. Gamble and R. C. Gifford.

Another annual gathering took place at Kingston when clocks were presented to Hawker long-service employees. Presentations were made to 51 employees (who had each served 25 years with the company) by Mr. Neville Spriggs, and by Mr. J. T. Lidbury, general manager; Sir Sydney Camm, chief designer; and Mr. J. D. Stranks, works director.

Transporting Dart Engines

EFFICIENT and safe surface transport of the Rolls-Royce Dart engine entails special problems, especially as it is inadvisable to employ any kind of steady at the end of the airscrew shaft.

Illustrated on this page is a transport cradle or stand evolved by Morfax, Ltd., of Willow Lane, Mitcham, Surrey, in collaboration with Mr. C. B. Harrison of Rolls-Royce, Ltd. It is suitable for either air or road transport, and has been specially designed for local handling by fork-lift trucks as well as by ordinary hoists. Combined weight of a Dart powerplant and the Morfax stand is approximately 2,000 lb.

The powerplant is cantilevered from the rear frame of the stand, utilizing the engine "W" struts, which pick up at four points; and the port and starboard trunnion mounting points are secured between two hemispherical Duralumin cups, thus leaving the airscrew shaft entirely clear. To facilitate interchangeability of powerplants, the cups and their mountings have been designed with an appreciable amount of axial and lateral adjustment.

The stand has been designed to carry either a complete powerplant, ready for installation in an airframe, or a bare engine. In the case of the latter no "W" struts are available, and therefore the four pick-up points cannot be employed. Instead, a single "V" strut is used, which picks up the top trunnion ball on the engine and the top two mounting brackets on the rear frame. The side trunnion points are again employed. The "V" strut is attached to the stand, but can be readily removed.

Above the stand, and supported at three points, is a lifting beam which spans the engine lengthwise and affords a degree of protection along its top. Hinged at the front, the beam can be lifted to facilitate engine loading or unloading, and can be removed entirely if necessary.

Attached to the underside of the stand are four shock-absorbers of the bonded rubber-to-metal type, which give a maximum vertical deflection of 2½in and are arranged to register with the base bolts or the existing Rolls-Royce transportation box.

A system of formed channels, suitably braced, running from front to rear and across the base of the stand have been provided to permit handling by fork lift truck. Thus, lifting can be effected from both sides and from the rear, the latter method being particularly suitable for loading into aircraft.

It is stated that Vickers-Armstrongs (Aircraft), Ltd., have ordered some 30 Morfax stands, which will be used in sending Dart engines abroad.

The Morfax stand, carrying a Dart, is moved by a Stocatruc.

Hospitality at Boscombe Down

AIRCRAFT-INDUSTRY representatives at the A. and A.E.E., Boscombe Down, met recently for their third annual dinner, at which a number of senior officers of the establishment were the guests. Of the 42 representatives present, a little under half were those who are permanently stationed at Boscombe Down, the remainder being visitors, many of them service managers, from the firms concerned. Speeches were brief; to the toast of "The Guests," proposed by Mr. R. G. Harvey (Rolls-Royce, Ltd.), a reply was made by A. Cdre. R. A. Ramsay Rae, the Air Commodore Commanding. Following are the names of those who attended:

Representatives.—W. Gilmour and A. C. Jack (Avro); J. Church (English Electric); S. A. Ashby, J. E. Lavender (Percival); W. R. Andrews, N. Wilson (Armstrong Whitworth); R. G. Harvey, H. Shaw (Rolls-Royce); G. Randall (Dowty), J. Hutchings, S. Sleigh (A.S.M.); A. Croft, D. F. Maclaren (Dunlop); A. C. Edwards, G. Wearen, A. H. Fenner, D. Scott, J. Bennet, D. Hutchings (de Havillands); C. W. Phillips, C. Goodier, J. F. Gale (Hawker); D. A. Warren, W. S. Purves, L. Swain (Westlands); E. Vousden, D. Menzies (Fairey's); F. A. Dare, C. S. Walker (Handley Page); F. Webb, F. J. Turton (Gloster); P. Newnham (Shorts); D. Campbell, W/C. F. White (Alvis); A. V. Edmunds, A. H. Neads, W/C. Campbell, H. J. Howell (Bristol); J. Forward, W/C. H. P. Powell (Lockheed); W. Kaye (Blackburn).

Guests.—A. Cdre. R. A. Ramsay Rae, Air Commodore Commanding; J. Hanson, Chief Superintendent; G/C. W. A. Theed, Superintendent, Armament; A. Spurr, representing Superintendent, Engineering; W/C. W. K. Bell, O.C. Servicing; W/C. C. L. C. Roberts, Wing Commander, Admin.; W/C. J. Rennie, Chief Radio Officer; Cdr. T. W. Lamb, Senior Naval Officer; W/C. F. R. Bird, O.C. "A" Sqn.; L/Cdr. H. Julian, representing "C" Sqn.; W/C. J. A. Brignall, O.C. Handling Sqn.; S/L. R. S. Baddeley, O.C. R. and I.; G/C. H. A. Purvis, Senior Civilian Pilot; W/C. C. K. Saxelby, O.C. "B" Sqn.

IN BRIEF

The Standard Motor Co. have recently signed an agreement with Auto Diesels, Ltd., of Uxbridge, whereby Standard engines are to be adapted for industrial and stationary application by the latter firm and marketed exclusively by them throughout the world. Auto Diesels' ground power units are well known in connection with aircraft starting and servicing.

* * *

The service department of the Goodyear Tyre and Rubber Company's aviation division is now established in its new quarters at London Airport—at the South-East Face Building, Central Area. Additional space is available, and it has been possible to increase the staff. The department at L.A.P., in close touch with the factories at Wolverhampton and Wallasey, is the base for servicing of Goodyear aviation products in Great Britain, Western Europe, Scandinavia, India and Australia.

* * *

Equipment fitted to the Comet 3 for its current long-distance flight programme includes a Smiths S.E.P.2 autopilot specially modified with a yaw damper (for both automatic and manual flight) and an airspeed lock; the latter, by giving close control of speed, does much to ensure economical cruising.

* * *

Another item of Comet 3 equipment concerns provision for recording interior and ambient temperatures. Two ElectroniK multi-point potentiometer recorders (supplied by Honeywell-Brown, Ltd.) are installed in the forward crew compartment. They print continuous records of thermocouple measurements made at twenty-four points inside and outside the aircraft; and, if necessary, the thermocouple locations can be redistributed to enlarge the scope of the investigation.

* * *

C. C. Wakefield and Co., Ltd., parent company of the Wakefield Group, announce that their principal subsidiary, W. B. Dick and Co., Ltd., is reconstituted as from January 1st under the name of Wakefield-Dick Industrial Oils Ltd. The new company will also embrace the functions of the former Wakefield-Dick industrial lubricants division of C. C. Wakefield and Co., Ltd., and will operate solely in the United Kingdom; export business will be conducted by the overseas division of the parent company. Mr. L. W. Farrow is chairman of the new company and Mr. L. M. Broadway deputy chairman and managing director.

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Teddington pneumatically-operated Butterfly Valves, made of Ni-resist cast iron, control air in areas having up to 250°C ambient temperature. Integral passages machined in the valve body upstream of the butterfly provide pressure for the actuating mechanism and the valve is opened or closed by a solenoid-operated vent.

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Ambient temperature range −60°C. to +250°C.
Minimum duct pressure for operating valve 5 p.s.i.
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Trade Advertisers who use these columns regularly are allowed a discount of 5% for 13, 10% for 26 and 15% for 52 consecutive insertion orders. Full particulars will be sent on application.

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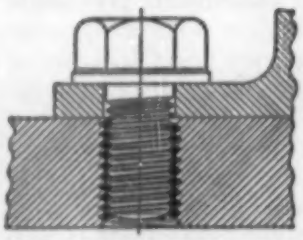

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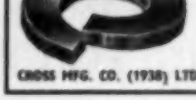

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(SENIOR & JUNIOR)

Consideration will also be given to Draughtsmen with Mechanical, Structural or Electrical Experience.

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The conditions of employment are good with progressive salary, good sports and welfare facilities, pension scheme, etc.

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SAUNDERS-ROE
LIMITED
require
Senior, Intermediate and Junior
DRAUGHTSMEN
STRESS ENGINEERS
AERODYNAMICISTS
and other Technicians at their London, Eastleigh and Osborne, I.o.W. design offices.

Applications will be welcomed from experienced technicians who are keen to join an expanding organisation engaged on interesting and important projects of an advanced nature.

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require
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for work on aircraft refrigeration turbines, and other equipment related to aircraft pressurising and air conditioning. Men without previous stressing experience will be considered, but minimum qualifications are a University degree or H.N.C.

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APPLICATION No. 693. From Eagle Aviation, Ltd., of 29, Clarges Street, London, W.1, for a Seasonal Inclusive Tour Service to be operated with Viking aircraft in conjunction with All Europe Tours for the carriage of passengers and supplementary freight between London (Blackbushe) and Bordeaux (Merignac) at a frequency of one return flight each Thursday during the season from March to November inclusive each year for a period of seven years, commencing 29th March, 1956.

THIS application will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to this application must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3, Dean's Yard, London, S.W.1, from whom further details of the application may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [4648

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POST C. Aerodynamicists and mathematicians for research and development work on aircraft projects, problems of auto-control, flight test and performance analysis, guided weapons, gas turbines.

QUALIFICATIONS—1st or 2nd class hons. degree in physics, maths., or engineering or equivalent. Research or development experience advantageous. At least three years' post graduate research experience for senior scientific officer. Appointments in scientific officer grade. Salary within range S.S.O.—£1,030-£1,185, S.O.—£448 10s.-£885 (superannuable). Women's salary subject to equal pay scheme. Applications from M.L.N.S., Technical and Scientific Register (K), 26 King Street, London, S.W.1, quoting C.753/5A/PO. Post A, B, or C. Closing date, 14th January, 1956. [4651

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For maintenance and calibration of flight test instruments and development of new equipment.

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Senior Draughtsman

for work on designing and detailing general test rigs and equipment. Minimum of 5 years' experience though not necessarily in the Aircraft Industry.

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for work on development of fuel systems and components. Knowledge of servo-mechanisms and hydraulics an advantage. Qualification H.N.C. or equivalent.

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Printed in Great Britain for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1, by SUN PRINTERS LTD., London and Watford, Herts. *Flight* can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch, Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service, Ltd.; Gordon & Gotch, Ltd. SOUTH AFRICA: Central News Agency, Ltd.; Wm. Dawson & Sons (S.A.), Ltd. UNITED STATES: The International News Co. Entered as Second Class Matter at the New York, U.S.A., Post Office.

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